NPL-U32-2-4-R3

FINAL
HAZARD RANKING SYSTEM DOCUMENTATION RECORD

LOWER DARBY CREEK AREA

DELAWARE AND PHILADELPHIA COUNTIES, PENNSYLVANIA

Prepared For:

U.S. Environmental Protection Agency
Region III
1650 Arch Street
Philadelphia, PA 19103

Prepared By:

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EPA Contract No.: 68-S5-3002
Technical Directive Document: 03-9908-0002

April 24, 2000

FINAL
HRS DOCUMENTATION RECORD

Site Name:	Lower Darby Creek Area
Contact Persons	
Site Contact:	Kevin Wood, U.S. Environmental Protection Agency (EPA) Region 3 (215) 814-3303
Documentation Record Contact:	Kevin Wood, EPA (215) 814-3303

Pathways, Components, or Threats Not Scored

The Hazard Ranking System (HRS) evaluation performed for the Lower Darby Creek Area is focused exclusively on the surface-water pathway. The ground water migration, soil exposure, and air migration pathways were not evaluated because their contribution to the overall score of the site is minimal.

FINAL
HRS DOCUMENTATION RECORD

Site Name: Lower Darby Creek Area

EPA Region: 3

Date Prepared: **January 3, 2000**
Revision I: **April 24, 2000**

Street Address of Site: Calcon Hook Road (using Folcroft Landfill)

County and State: Delaware and Philadelphia Counties, Pennsylvania

General Location in the State: Southeastern Pennsylvania (Figure 1)

Topographic Maps: U.S. Geologic Survey (USGS), Bridgeport, NJ-PA and Lansdowne, PA, 1967

Latitude: 39°53′44″ N (Ref. 78)* Longitude: 75°15′41.5″ W (Ref. 78)*

*An aboveground storage tank on the Darby Creek Tank Farm, located in Philadelphia County, was used as the reference point (see Reference 78).

WORKSHEET FOR COMPUTING HRS SITE SCORE

		S	S^2
1.	Ground Water Migration Pathway Score (S_{gw}) (from HRS Table 3-1, Line 13)	NS[a]	NS
2a.	Surface Water Overland/Flood Migration Component (from HRS Table 4-1, Line 30)	100	10,000
2b.	Ground Water to Surface Water Migration Component (from HRS Table 4-25, Line 28)	NS	NS
2c.	Surface Water Migration Pathway Score (S_{sw}) (Enter the larger of the two scores from Lines 2a and 2b as the pathway score).	100	10,000
3.	Soil Exposure Pathway Score (S_s) (from HRS Table 5-1, Line 22)	NS	NS
4.	Air Migration Pathway Score (S_a) (from HRS Table 6-1, Line 12)	NS	NS
5.	Total of $S_{gw}^2 + S_{sw}^2 + S_s^2 + S_a^2$		10,000
6.	**HRS Site Score** Divide the value on Line 5 by 4 and take the square root		50

Note:

[a] NS = Not scored

LOWER DARBY CREEK AREA
SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET

	Factor Categories and Factors	Maximum Value	Value Assigned
Drinking Water Threat			
	Likelihood of Release		
1.	Observed Release	550	550
2.	Potential to Release by Overland Flow		
	2a. Containment	10	NS
	2b. Runoff	25	NS
	2c. Distance to Surface Water	25	NS
	2d. Potential to Release by Overland Flow [lines 2a x (2b +2c)]	500	NS
3.	Potential to Release by Flood		
	3a. Containment (Flood)	10	NS
	3b. Flood Frequency	50	NS
	3c. Potential to Release by Flood [lines 3a x 3b]	500	NS
4.	Potential to Release [lines 2d + 3c]	500	NS
5.	Likelihood of Release [higher of lines 1 and 4]	550	NS
	Waste Characteristics		
6.	Toxicity/Persistence	a	NS
7.	Hazardous Waste Quantity	a	NS
8.	Waste Characteristics	100	NS
	Targets		
9.	Nearest Intake	50	NS
10.	Population		
	10a. Level I Concentrations	b	NS
	10b. Level II Concentrations	b	NS
	10c. Potential Contamination	b	NS
	10d. Population [lines 10a + 10b + 10c]	b	NS
11.	Resources	5	NS
12.	Targets [lines 9 + 10d + 11]	b	NS
	Drinking Water Threat Score		
13.	Drinking Water Threat Score [lines 5 x 8 x 12)/82,500][c]	100	NS

[a] Maximum value applies to waste characteristics category
[b] Maximum value not applicable
[c] Do not round to nearest integer
NS Not scored

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET (Cont.)

	Factor Categories and Factors	Maximum Value	Value Assigned
Human Food Chain Threat			
	Likelihood of Release		
14.	Likelihood of Release [same value as line 5]	550	550
	Waste Characteristics		
15.	Toxicity/Persistence/Bioaccumulation	a	5×10^{8}
16.	Hazardous Waste Quantity	a	100
17.	Waste Characteristics	1,000	320
	Targets		
18.	Food Chain Individual	50	45
19.	Population		
	19a. Level I Concentrations	b	0
	19b. Level II Concentrations	b	0.03
	19c. Potential Contamination	b	NS
	19d. Population [lines 19a + 19b + 19c]	b	0.03
20.	Targets [lines 18 + 19d]	b	45.03
	Human Food Chain Threat Score		
21.	Human Food Chain Threat Score [lines 14 x 17 x 20)/82,500][c]	100	96.06

[a] Maximum value applies to waste characteristics category
[b] Maximum value not applicable
[c] Do not round to nearest integer
NS Not Scored

SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORESHEET (Cont.)

	Factor Categories and Factors	Maximum Value	Value Assigned
Environmental Threat			
	Likelihood of Release		
22.	Likelihood of Release [same value as line 5]	550	550
	Waste Characteristics		
23.	Ecosystem Toxicity/Persistence/Bioaccumulation	a	5×10^{8}
24.	Hazardous Waste Quantity	a	100
25.	Waste Characteristics	1,000	320
	Targets		
26.	Sensitive Environments		
	26a. Level I Concentrations	b	8,750
	26b. Level II Concentrations	b	NS
	26c. Potential Contamination	b	NS
27.	Targets [lines 26a + 26b + 26c]	b	8,750
	Environmental Threat Score		
28.	Environmental Threat Score [lines 22 x 25 x 27)/82,500][c]	60	60
	Surface Water Overland/Flood Migration Component Score for a Watershed		
29.	Watershed Score [lines 13 + 21 + 28][c]	100	100
	SURFACE WATER OVERLAND/FLOOD MIGRATION COMPONENT SCORE		
30.	Component Score (S_{of})[c] [highest score from line 29 for all watersheds evaluated][c]	100	100

[a] Maximum value applies to waste characteristics category
[b] Maximum value not applicable
[c] Do not round to nearest integer
NS Not scored

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3.	Tetra Tech EM Inc. (Tetra Tech). Record of Telephone Conversation Regarding Darby Creek Tank Farm. From Alicia Shultz, Project Manager. To Steve Coladonato, Project Manager, Sun Oil Corporation. February 8, 2000 (1 page).
4.	EPA. Environmental Monitoring Systems Laboratory. Site Analysis, Clearview Landfill, Delaware County, PA. November 1984. (29 pages).
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7.	EPA. Recommendations Regarding Clearview Site. November 19, 1984. (2 pages).
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10.	Tetra Tech. Record of Telephone Conservation Regarding Paulsboro Borough Water Supply. From Brian Croft, Environmental Scientist. To Mike Williams, Superintendent of Public Works Gibbstown, New Jersey. October 17, 1999. (1 page).
11.	*Delaware County Sunday Times*. "Local Groups Challenge EPA on Wastes." June 6, 1985. (1 page).
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1.0 INTRODUCTION

The sections below present general information about the site, the location of the site, operations at the site, sources of potential contamination that were not evaluated, and the geology of the area.

General Site Information

The Lower Darby Creek Area (LDCA) site is located in an industrialized portion of southeastern Delaware County and southwestern Philadelphia County, Pennsylvania. The site is located along an approximately two-mile stretch of Darby Creek, between Cobbs Creek to the north and the tidal marsh of John Heinz National Wildlife Refuge (NWR) at Tinicum to the south (Ref. 31, pp. 1, 2, and 3). The LDCA site also includes more downstream areas of Darby Creek and the tidal marsh, where contamination also has come to be located (Ref. 1, p. 51587). Darby Creek generally flows from north to south through the LDCA site and discharges to the Delaware River a few miles downstream (Ref. 34).

The LDCA site is located primarily in Darby Township and Folcroft Borough in Delaware County, but also extends into the City and County of Philadelphia. Interstate 95 and the Philadelphia International Airport are located within one mile to the southeast (Ref. 31, pp. 1, 2, 3) (Figure 1).

The LDCA site includes several waste sources, located on both sides of Darby Creek (Figure 1). In the Documentation Record, the waste sources are evaluated as a single site or release for several reasons. First, each of the waste sources is a known or very likely contributor to a release of hazardous substances to Darby Creek, which is the basis for listing the site on the National Priorities List (NPL). Second, the majority of the hazardous substances in the release to Darby Creek are attributable to multiple waste sources. Third, the release to Darby Creek has affected or might affect the same portion of the creek, which includes fisheries, wetlands, and other sensitive environments, including the John Heinz NWR at Tinicum. All of these statements are documented in later sections of the Documentation Record.

Source Locations

The seven sources that are included in the LDCA site border Darby Creek from north to south, as follows: the Clearview Landfill (east side of Darby Creek), the Industrial Drive properties (west side of Darby Creek), the Catalyst Disposal Area (west side of Darby Creek), the Oily Sludge Disposal Area (west side of Darby Creek), the Sewage Sludge Disposal Area (west side of Darby Creek), the former Delaware County Incinerator Landfill (west side of Darby Creek), and the Folcroft Landfill and Folcroft Landfill Annex (west side of Darby Creek) (Ref. 31, p. 2) (Figure 1).

Source Operations

The seven sources included under this HRS package have been involved in various operations that are discussed in this section. The Clearview Landfill (Source 1) operated without a permit from the late 1950s until approximately 1973 and was used for the disposal of municipal wastes generated by the city of Philadelphia and portions of Delaware County (Ref. 31, pp. 14 to 16; Ref. 5, p. 1). Because of

A copy of Figure 1 is available at the EPA Headquarters Superfund Docket:

U.S. CERCLA Docket Office
Crystal Gateway #1, 1st Floor
1235 Jefferson Davis Highway
Arlington, VA 22202

Telephone: (703) 603-8917
E-Mail: superfund.docket@epa.gov

several violations of state regulations, and the absence of a permit, the Pennsylvania Department of Environmental Resources (PADER) took court action under which the landfill was closed in August 1973 (Ref. 31, p. 16).

As a result of interpretation of aerial photographs completed for the Clearview Landfill, properties along the Industrial Drive (Source 2) were identified as an area at which dumping has occurred since at least 1953 (Ref. 37, pp. 2 and 8). Currently, several salvage yards and a vehicle repair garage occupy the area (Ref. 31, p. 14). A soil sample collected near Darby Creek behind an auto repair garage during an EPA site investigation (SI) detected hazardous substances in the area (Ref. 31, p. 20 and Table 5c). As of February 2000, the Industrial Drive Properties included the following businesses: Atlas Recycling, American Sheet Metal, Lombardo Scrapyard/Fairview Hauling, Ray's Truck Parts, Gricco's Garage, Bruce's Auto Body, Salerno Tire, and Bell Atlantic Mobile (cellular telephone tower) (Ref. 90, p. 1). Soil samples collected from the Industrial Drive Properties revealed signficant concentrations of metals and PAHs (Ref. 9, Table 1, pp. 5 and 6; Table 3, pp. 12 and 13; and Table 9, p. 22).

The Oily Sludge Disposal Area (Source 3) and the Catalyst Disposal Area (Source 4) are located on the Sun Oil Darby Creek Tank Farm. The Oily Sludge Disposal Area was used for the disposal of oily dirt generated from the Gulf Oil Refinery, located on the east bank of the Schuykill River. The area used for disposal was an excavation remaining from a former gravel quarry. The Catalyst Disposal Area was used for the disposal of catalyst contaminated with acid, also from the Gulf Oil Refinery (Ref. 74, p. 2-5). The area was a basin or pond that was filled with catalyst waste (Ref. 73, p. 1).

The Sewage Sludge Disposal Area (Source 5) is located at the former Delaware County Sewage Treatment Plant. Dried sludge from plant operations was disposed of in this source, located along Darby Creek, until approximately 1974 (Ref. 31, pp. 9 to 10).

The former Delaware County Incinerator Landfill (Source 6) operated from the mid-1960s until 1978. The 15-acre landfill was created by landfilling areas around the former Delaware County Incinerator No. 2 with ash residue generated by the incinerator. The incinerator managed approximately 500 to 800 tons of refuse per day (Ref. 31, p. 7).

The Folcroft Landfill and Annex (Source 7), located on the John Heinz NWR, were permitted from approximately 1959 until 1974 to accept municipal, demolition, and hospital wastes. However, analysis of aerial photographs indicates that disposal activity took place as early as 1953 and that, by 1958, the landfill covered approximately two acres. Inspection reports prepared by PADER indicate that numerous permit violations occurred during operations (Ref. 31, p. 4).

The table below summarizes the sources evaluated in this HRS documentation record and their source numbers. Figure 1 shows the locations of the sources.

TABLE 1
SUMMARY OF SOURCES EVALUATED

Source Name	Source Number
Clearview Landfill	Source 1
Industrial Drive Properties	Source 2
Oily Sludge Disposal Area	Source 3
Catalyst Disposal Area	Source 4
Sewage Sludge Disposal Area	Source 5
Delaware County Incinerator Landfill	Source 6
Folcroft Landfill and Annex	Source 7

Sources of Potential Contamination to Darby Creek - Not Evaluated

Four sources of potential contamination to Darby Creek and the John Heinz NWR have been identified and were not evaluated within this HRS documentation record. One the sources, the Norwood Landfill, is located along the southwest edge of the John Heinz NWR in Norwood, Pennsylvania southwest of the LDCA site. The U.S. Fish and Wildlife Service (FWS), U.S. Department of the Interior (DOI) is considering the purchase of the property on which the Norwood Landfill is located. According to available reports this area was used during the 1960s by the Borough of Norwood as a municipal landfill. A survey completed on the property in 1993 reported debris scattered across the property that included large amounts of glass; automobile frames and parts; aluminum siding; asphalt; concrete; and tires. It has also been reported that dredge material was disposed of on the property after the municipality ceased landfill activities (Ref. 77, p. 1-1). Analytical results of soil samples collected from the property in 1999 identified elevated levels of polyaromatic hydrocarbons (PAHs) and metals (Ref. 77, pp. 3-3 through 3-8). The property is currently heavily vegetated (Ref. 77, p.1-1). Darby Creek is located along the property's southeastern location (Ref. 77, p. 2-1a).

A second source which is not evaluated is the Boeing Defense and Space Group property located in Ridley Park, Pennsylvania, downstream of the confluence of Darby Creek and the Delaware River, southwest of the LDCA site (Ref. 48, pp. 3 and 4). The Boeing Defense and Space Group property covers 350 acres and is divided into three contiguous areas, known as Center South, Center North, and the 63-Acre Site (Ref. 87, p. 2). Ground water contamination has been identified at the 63-Acre Site. From 1880 until 1956, the property was occupied by Baldwin Locomotives. Baldwin manufactured steam and diesel locomotives. Upon cessation in 1956, most of the structures were demolished, leaving the foundations which are still visible. The property is currently vacant and overgrown. Crum Creek, a tributary of the Delaware River, winds through the center of the property. In 1987, Boeing Helicopters acquired the property (Ref. 48, p. 3). Soil samples from the property revealed total petroleum hydrocarbons (TPH).

Ground water analytical results revealed significant concentrations of TPH, trichloroethylene (TCE), and acetone (Ref. 48, pp. 24, 25, and 26).

Ground water contamination has also been identified at the Center North section of the Boeing Defense and Space Group property. Ground water was found to be contaminated with volatile organic compounds (VOCs) and TCE in both overburden and bedrock aquifers. A ground water extraction and treatment system was installed to treat the contaminated ground water (Ref. 87, p. 2).

The Boeing Defense and Space Group also holds a National Pollution Discharge Elimination System (NPDES) permit to discharge treated process wastewater from a wastewater treatment plant to Crum Creek, Darby Creek, and the Delaware River (Ref. 88, p. 1; Ref. 6, Figure 3-2).

A third source which is not evaluated is a transformer storage area located on the Delaware County Sewage Treatment Plant within the area of the LDCA site. The source was identified during a February 2000 sampling investigation. A soil sample (STP-SD-4) was collected from the area of the transformer revealing 1,400 micrograms per kilogram of Aroclor 1260 (Ref. 90, Table 1, p. 6, Appendix F, p. F-126, and Figure 4, p. 9).

The fourth source is the hydrofluoric-acid-contaminated trash dispsoal area located on the Darby Creek Tank Farm within the area of the LDCA site. The waste was generated from a refinery process that used acid. The contaminated waste was neutralized with caustic soda prior to disposal (Ref. 74, p. 4-1 and Figure 2-2, p. 2-3; Ref. 73, pp. 1, 2, and 14).

Geology of the Lower Darby Creek Area

The Lower Darby Creek Area is underlain by the Quaternary Age Trenton Gravel Formation, which consists primarily of medium to coarse-grained gravelly sand, with interbedded clayey silt and sand layers. The Trenton Gravel Formation ranges in thickness from 30 to 40 feet (Ref. 24, III-54; Ref. 74, p.3-3). Beneath the Trenton Gravel lie the Pennsauken and Bridgeton formations, which consist of crossbedded cemented sands, with interbedded coarse-grained gravels. Those formations have a maximum thickness of 30 feet and are present as outcrops in the study area (Ref. 74, p. 3-5). The depth to ground water directly beneath the site is unknown; however, wells located at or near the Folcroft Landfill and John Heinz NWR indicate a depth to ground water of approximately 4 to 10 feet below ground surface (bgs) (Ref. 24, p. III-57).

Beneath the units described above lie the Cretaceous Age Potomac Group and Raritan Formation; along with the Pennsauken Formation, the Bridgeton Formation, and the Magothy Formation (present in New Jersey), those units make up the Potomac-Raritan-Magothy aquifer, which is a major water supply source for residents of New Jersey (Ref. 74, p. 3-3). The Potomac-Raritan-Magothy aquifer is divided into six units: upper clay, upper sand, middle clay, middle sand, lower clay, and lower sand.

The Potomac-Raritan-Magothy aquifer ranges in thickness from approximately 150 feet to 295 feet and probably extends beneath the Lower Darby Creek area. However, no documentation has been obtained to support that statement (Ref. 74, pp. 3-3 to 3-5).

The Precambrian Age Wissahickon Schist Formation is present beneath the layers described above. That formation consists primarily of oligoclase-mica schist (Ref. 24, p. III-54; Ref. 74, p. 3-5; Ref. 5, p. 3). Because of the intense folding of that unit, its exact thickness is unknown; however, it is estimated to range from 8,000 to 10,000 feet in thickness (Ref. 74, p. 3-5). The Wissahickon Schist Formation is also present within the study area (four-mile radius) as outcrops in stream channels (Ref. 74, p. 3-5).

Drinking-water Wells

No drinking-water wells on the Pennsylvania side of the Delaware River are known to exist within the study area (Ref. 71). On the New Jersey side of the Delaware River, drinking-water wells for Gibbstown and the borough of Paulsboro are located outside of the study area, according to telephone conversations with local officials (Refs. 10 and 70). No significant target population has been identified within a four-mile radius of the study area; therefore, the ground water migration pathway was not evaluated.

SOURCE DESCRIPTION

2.2 Source Characterization

Source Number: 1

HRS Source Type: Landfill

Source Description: Clearview Landfill

The Clearview Landfill is located along the eastern bank of Darby and Cobbs Creeks, at 83rd Street and Buist Avenue (Figure 1). It is located partially in Darby Township, Delaware County and partially in Philadelphia County, Pennsylvania (Ref. 5, p.1). Aerial photographs indicate that the landfill was as large as 65 acres (Ref. 4, p. 16). According to reports, the landfill was located on a 50-acre parcel of land that the Clearview Land Development Corporation owned since the late 1950s. An unpermitted municipal waste landfill has been operated at the location since the late 1950s. D. Richard Heller is the owner of Clearview Land Development Corporation (Ref. 5, p.1). The owners failed to meet the provisions of an interim consent order issued in November 1971; therefore, the state issued a petition for contempt of the interim consent order in January 1973 (Ref. 5, p. 1). The property was used to dispose of municipal wastes from the City of Philadelphia and portions of Delaware County. In December 1970, the state filed an injunction against the landfill for operating without a permit (Ref. 5, p. 1). In February 1973, a judge ordered Clearview Land Development Corporation to submit a final closure plan. On September 30, 1973, a final order was issued under which all disposal activities at the landfill were to cease and the Clearview Land Development Company was to follow a prescribed closure plan (Ref. 5, p. 1). In 1976, the Philadelphia Redevelopment authority covered and seeded a portion of the landfill. Between 1976 and 1977, hundreds of residences were constructed around the eastern and southern borders of the landfill (Ref. 5, p.2).

The U.S. Environmental Protection Agency's (EPA) Environmental Photographic Interpretation Center, Environmental Monitoring Systems Laboratory completed an analysis of the Clearview Landfill (Ref. 4, p. *i*). The 1953 aerial photograph of Clearview Landfill shows a 3.3-acre area of debris and mounded earthen material located north and south of an access road leading into the property from Buist Avenue. The photograph shows that the property was situated on and surrounded by wetlands and a stream flows through the landfill along the eastern (Ref. 4, pp. 6, 7, and 8). Aerial photographs from 1958 to 1973 show that these wetlands and the stream become landfilled (Ref. 4, pp. 6, 7 ,8, 9, 10, 11, 13, 14, 15, 16, and 17).

In 1973, the landfill expands to 65 acres (Ref. 4, pp. 16, and 17). Pools of standing liquid and pits containing liquid are observed on the landfill surface in several of the aerial photographs (Ref. 4, pp. 10, 11, 12, 13, 18, 19, and 20). The constituents of the liquid have not been determined. The aerial photographs indicate that large quantities of liquid were disposed of in the landfill. Dark stains are also observed on the landfill (Ref. 4, pp. 18, 19, and 20). Tank cars and tanks are observed on the landfill indicating that liquid wastes may have been brought to the landfill (Ref. 4, pp. 18 and 19).

The 1973 aerial photograph shows the presence of new residences constructed east of the landfill (Ref. 4, pp. 16 and 17). A recreation area is under construction at the northeast corner of the landfill in the April 1979 aerial photograph (Ref. 4, p. 20). The June 1983 aerial photograph shows new residences

constructed at the southeast corner of the landfill, possibly on top of a former fill area that had been visible in the aerial photograph taken in 1953 (Ref. 4, pp. 6, 7, 22, and 23).

On June 12, 1980, Pennsylvania Department of Environmental Protection (PADEP) conducted an investigation of the reported dumping and open burning of waste materials at the Clearview Landfill. The investigation found that waste material, including demolition wastes, tires, furniture, household appliances, and bedding, had been deposited at the top and on the southwest face of the landfill, and that an area on the east bank of Cobbs Creek was being filled in with material consisting of significant quantities of lumber, rugs, and other materials that were not "clean fill" materials. A notice of violation (NOV) was issued to Richard Heller of Clearview Land Development (Ref. 64).

On November 25, 1981, DEP conducted an inspection of Clearview Landfill and nearby areas. During the inspection, the following conditions were noted at the landfill: a dump area between 84th Street and the owner's office building consisting of a large quantity of demolition debris, bulky items, old car parts, and trash; a dump area between 84th Street and the foot of the landfill, consisting of a large amount of demolition debris, old tires, concrete, and trash; and several areas on top of the landfill, consisting of at least 15 cubic yards of granular insulation, at least 10 cubic yards of a black ash, and several piles of demolition debris in the area of the owner's office. In addition, large storage containers owned by Graves Resource Management (GRM) (an unpermitted transfer, storage, and disposal facility for hazardous waste that operated between 1980 and 1981 and was located south of the landfill) were present. Those conditions were in direct violation of an August 7, 1973 court-ordered closure of the landfill, a PADEP order to close the GRM facility, the Pennsylvania Solid Waste Management Act (PA SWMA), and several sections of PADEP's rules and regulations. Therefore, PADEP issued another NOV to Mr. Heller (Ref. 19).

On December 17, 1982, PADEP conducted an inspection of Clearview Landfill and noted that waste materials had been deposited directly on the ground. The waste material included demolition debris, abandoned automobiles and automobile parts, and scrap metal. PADEP notified Clearview Landfill of those violations of the PA SWMA and several sections of PADEP's rules and regulations. Therefore, PADEP issued a third NOV to Mr. Heller (Ref. 65).

On May 16, 1984; December 8, 1986; and October 27, 1987; PADEP sent Mr. Heller additional NOVs for numerous violations of the PA SWMA (Ref. 69, p. 4).

On September 27, 1982, Robert Zang of PADEP conducted a SI of the landfill. In his SI report, Mr. Zang stated that the landfill is more than 100 acres in size (Ref. 9, p. 3). He stated further that a leachate pond is present on the landfill near Darby Creek and that a foul odor was present when he walked through the stream to conduct sampling (Ref. 9, p. 6).

EPA Region 3's Field Investigation Team (FIT3) completed SIs at the landfill. On October 6, 1983 and August 6 and October 1, 1984, surface water, sediment, soil, and leachate samples were collected from the landfill and Darby Creek (Ref. 12, p. 5-1; Ref. 13, pp. 1 and 2). Polychlorinated biphenyls (PCB) and polyaromatic hydrocarbons (PAH) were revealed in leachate, PAHs were detected in soil, and PCBs were detected in stream and soil samples (Ref. 5, p. 2; Ref. 12, p. 6-3; Ref. 13, pp. 2 and 5). On September 25, 1990, the FIT3 observed areas of recent dumping throughout the landfill and three leachate seeps on the western edge that were draining into Darby Creek. VOCs, semivolatile organic compounds (SVOC), and PAHs were detected in the leachate seeps and downstream sediments (Ref. 5, p. 3).

Illegal disposal of waste at the landfill has continued to the present. According to the PADEP complaint of equity against Richard Heller, evidence of waste deposition was observed at the landfill throughout 1997 and 1998 (Ref. 69, pp. 1, 4 through 8).

In May 1998, EPA sampled the landfill as part of a comprehensive sampling effort in the area of Darby Creek. Soils and waste source samples collected from the landfill contained elevated levels of metals, PAHs, and PCBs (Ref. 31, p. 28). The locations of the samples are shown on Figure 2.

In April 1999 an emergency reponse was conducted at a site called the 80th and Mars Place Site (Ref. 91, p. 1). A review of the aerial photographs from the Clearview Landfill and the location of that site indicates that the site may be part of the Clearview Landfill (Ref. 91, p. 1 and Figure 2, p. 2; Ref. 4). Three surface soil samples were collected from the site. According to trip report, significant concentrations of the following hazardous substances were detected in the soil samples: benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, Aroclor-1260, aluminum, arsenic, cadmium, manganese, and vanadium (Ref. 91, pp. 4 and 5 and Attachment 1).

In addition to the unpermitted landfilling activities described above, the property historically was used for other waste disposal operations. In 1973, PADEP granted ROMA Associates, Incorporated a permit to construct and operate a batch asphalt plant south of the landfill. The asphalt plant operated from 1973 until 1976 (Ref. 5, p. 2). GRM operated a hazardous waste treatment, storage, and disposal facility (TSDF) at the Clearview Landfill (Ref. 18 and Ref. 38). A PADEP order dated November 19, 1981 found that the company continued to operate the TSDF in violation of Section 403 of the SWMA (Ref. 18, p. 1). In the order, numerous violations are cited, including acceptance of wastes from unliscensed haulers; failures to maintain the facility so as to minimize the possibility of release of waste to the environment; and the presence of containers at the facility that are not closed during storage and not managed to prevent leaks and spills of waste (Ref. 18, p. 2). Because of the numerous violations, the facility's interim status was revoked (Ref. 18, p. 3). The owner of the operation was Albert F. Ingram (Ref. 8). In 1984, Mr. Ingram was sentenced to a prison term for two counts of transporting and dumping hazardous wastes committed in 1982 (Ref. 8).

In the late 1980s three other companies operated by Mr. Heller were located at the same location as the landfill. Those companies were DeLorenzo Twin County Disposal, Bizarro Corporation, and Eagleville Excavating (Ref. 5, p. 2). In October 1982, Delorenzo applied for a permit to operate a solid waste transfer station (Ref. 14).

A copy of Figure 2 is available at the EPA Headquarters Superfund Docket:

U.S. CERCLA Docket Office
Crystal Gateway #1, 1st Floor
1235 Jefferson Davis Highway
Arlington, VA 22202

Telephone: (703) 603-8917
E-Mail: superfund.docket@epa.gov

In addition to the detection of hazardous substances in soil and leachate samples collected at the site, testimony from former employees documented the disposal of hazardous substances at the Clearview Landfill. In 1984, a former employee of the Clearview Landfill testified in court that he had helped bury poisonous chemicals at the landfill while he was employed there from 1966 to 1973. The former employee stated that he frequently had worked with chemicals at the landfill and would be ill for at least a day, particularly after he helped fight fires. The employee was testifying at a Worker's Compensation hearing in the case of his uncle, another employee of the landfill who had died of cancer in 1962. The wife of the deceased employee had filed a claim charging that toxic wastes at the Clearview Landfill were responsible for the death. Under examination during the court proceedings, the former employee, who had operated a bulldozer at the landfill, stated that the operator of the landfill would accept anything, including drums of poisonous wastes. He stated further that the landfill frequently took loads of drums from the Dupont Paint Company that sometimes were marked clearly to be poison. He stated that his late uncle often punctured the drums with the bulldozer blades and pushed the debris into a massive mound of trash. Other times they broke the drums and dumped them into a massive "paint pit" at the landfill. The pit has since been covered with dirt. The former employee stated that his uncle broke the drums because, if the men ran over the drums with a bulldozer, the drums would explode and the men would be doused with poisonous chemicals. The former employee once was hospitalized for more than a week for chemical burns after a barrel exploded and he was sprayed. Mr. Heller often called him in the middle of the night to fight fires because local firefighters refused to respond. The former employee stated that, after they fought the fires, he experienced a burning sensation in his throat and vomited for days. He stated that he was exposed to so many hazardous chemicals at the landfill and that his clothes pulled apart after light wear and he went through a pair of shoes in a month (Ref. 40).

Source Location:

Source 1 is located along the eastern bank of Darby and Cobbs Creeks, at 83rd Street and Buist Avenue. It is located partially in Darby Township, Delaware County, and partially in Philadelphia County, Pennsylvania (Ref. 5, p.1 and Attachment 1) (Figures 1 and 2).

Containment:

Release to Groundwater: The ground water pathway was not evaluated.

Release via overland migration and/or flood: There is no documentation of a maintained engineered cover or functioning and maintained runon control system and runoff management system at Source 1; therefore, a containment factor of 10 was assigned (Ref. 1, p. 51609; Ref. 5, p. 4; Ref. 36, p. IV-9).

Gas Release to Air: The air migration pathway was not evaluated.

Particulate Release to Air: The air migration pathway was not evaluated.

2.4.1 Hazardous Substances

EPA has collected samples from the Clearview Landfill on four occasions. Hazardous substances have been detected in leachate flowing from the landfill, as well as in soil samples collected from the landfill, as summarized in Table 2.

Table 2
HAZARDOUS SUBSTANCES DETECTED AT CLEARVIEW LANDFILL
PAGE 1 OF 2

Sample ID		C4170		02	03	04	05	06	07	08	CCY79		CCY80/MCEC80		CCY83		CLF/SS09
Sample Date		10/6/83		1984	1984	1984	1984	1984	1984	1984	9/25/90		9/25/90		9/25/90		May 18 - 28, 1998
Reference		12, pp. 6-3, 7-43, 7-44		5, p. 18	5, p. 18	5, p. 18	5, p. 18	5, p. 18	5, p. 18	5, p. 18	5, pp. 25 and 30		5, pp. 25 and 30		5, pp. 25 and 30		31, Table 5-C, p. 2, 19, and 9-B-38,
Sample Location	CRDL	Leachate	Q	Junkyard Soil (6-12")	Junkyard Soil (12-18")	Soil Below Drum Area (6-12")	Soil Above Transfer Station (6-12")	Soil Along Access Road (6-12")	Soil Along Access Road Closest to Site	Soil Along Access Road Furthest From Site	LD1 - Leachate	Q	LD2 - Leachate	Q	LD5 - Leachate	Q	Landfill Surface Soil
SVOCs (µg/kg)																	
Anthracene	330				1000												
Benzo(a)anthracene	330	1400			1100	2000			1600		1200	J	1100	J	1000	J	690
Benzo(a)pyrene	330	1100				2100			1400		1200	J	1100	J	1000	J	670
Benzo(b)fluoranthene	330	970				2300			1400		1200	J	1100	J	1100	J	1100
Benzo(g,h,i)perylene	330										810	J	780	J	650	J	530
Benzo(k)fluoranthene	330				1800	1900			1600		1300	J	1000	J	1000	J	
Chrysene	330	1300			1100	2100			1700		1500	J	1300	J	1200	J	750
Fluoranthene	330	2800		1100	3200	4500		1400	3700	1000	2500	J	2200	J	1800	J	
Indeno(1,2,3-cd)pyrene	330										750	J	740	J	680	J	540
Phenanthrene	330	1700		1000	3700	2900		1200	2500		2000	J	1900	J	1500	J	750
Pyrene	330	3100		1200	2700	3900		1200	3500		2400	J	2200	J	1600	J	1200
Pesticides/PCBs (µg/kg)																	
Aroclor - 1248	33	370															
Aroclor - 1254	33																240
Aroclor - 1260	33	227					420	420	143,000	310							250 B
Chlordane (alpha)	1.7																4.1 J
Chlordane (gamma)	1.7																6.8 J
4,4 - DDD	3.3																12 J
4,4 - DDE	3.3																6.6 J
4,4 - DDT	3.3																8.4 J
Endrin aldehyde	3.3																13 J

Table 2
HAZARDOUS SUBSTANCES DETECTED AT CLEARVIEW LANDFILL
PAGE 2 OF 2

Sample ID		CLF/SS07		CLF/SS07A		CLF/SS09		CLF/SS10	
Sample Date		May/June 1998		May/June 1998		May/June 1998		May/June 1998	
Reference		31, pp. 19, Table 5a, p. 1 of 3 and p. 9-a-4		31, p. 19, Table 5a, p. 1 of 3, and p. 9-a-9		31, pp. 19, Table 5a, p. 1 of 3 and p. 9-a-9		31, p. 20, Table 5a, p. 1 of 3 and p. 9-a-4	
Sample Location	CRDL	Debris Pile	Q	Duplicate of CLF/SS07	Q	Surface Soil, Clearview Landfill	Q	Debris Pile	Q
Compounds (mg/kg)									
Antimony	12	3.6	L	3.7	L	8.5	L	7.3	L
Arsenic	2	5.8		6		12.9		7.5	
Barium	40	287		233		264		173	
Cadmium	1	2.2		2.5		2.4		2.8	
Calcium	1,000	7,370	J	6,460	J	5,610	J	8,180	J
Copper	5	102	J	110	J	442	J	297	J
Iron	20	25,000		33,500		101,000		46,100	
Lead	0.6	538		563		849	B	468	
Mercury	0.1	0.51		0.5		0.56	L	0.38	
Nickel	8	21.7		24.1		61.2		41.7	
Selenium	1			131			UL		
Silver	2	6.1		7		2		2.9	
Zinc	4	412		397		1,500		1,260	

B Not detected significantly above the concentration detected in the laboratory blank.
CRDL Contract Required Detection Limit
J Estimated value. Actual value may be higher or lower.
L Analyte present. Reported value may be biased low. Actual value is expected to be higher.
mg/kg Milligram per kilogram
μg/kg Microgram per kilogram
Empty Cell indicates that the compound was not detected.
Sample SS08 was not included because it was collected as a reference sample near a playground (Ref. 31, p. 19).

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

Information available is not sufficient to adequately support the evaluation of the hazardous constituent quantity for Source 1.

Sum (pounds): Unknown
Hazardous Constituent Quantity Value (C): NA

2.4.2.1.2 Hazardous Waste Stream Quantity

Information available is not sufficient to adequately support the evaluation of the hazardous waste stream for Source 1.

Sum (pounds): Unknown
Hazardous Waste Stream Quantity Value: NA

2.4.2.1.3 Volume

Information available is not sufficient to adequately support the evaluation of the volume for Source 1.

Dimension of source (yd^3 or gallons): Unknown
Volume Assigned Value: NA

2.4.2.1.4 Area

A PADEP inspector estimated the size of the landfill to be in excess of 100 acres during a 1982 SI (Ref. 9, p. 3). The March 1973 aerial photograph interpretation estimated the size of the landfill at 65 acres (Ref. 4, pp. 16 and 17). To calculate a conservative HWQ value, 65 acres is used for the area calculation. The area divisor for determining the HWQ value assigned to a landfill is 3,400 (Ref. 1, p. 57591). The calculation of the HWQ value on the basis of the area of Source 1 is 65 acres x 43,560 ft^2/acre = 2,831,400 ft^2. The calculation of the HWQ value on the basis of the area of Source 1 is 2,831,400/3,400 resulting in a value of 832.77

Area of source (ft^2): 2,831,400
Area Assigned Value: 832.77

2.4.2.1.5 Source Hazardous Waste Quantity Value

The source HWQ value for Source 1 is the value for the area of the landfill.

Source Hazardous Waste Quantity Value: 832.77

SOURCE DESCRIPTION

2.2 Source Characterization

Source Number: 2

HRS Source Type: Contaminated Soil

Source Description: Industrial Drive Properties

Industrial Drive is a short street that runs south from Hook Road, slightly west of and parallel to Darby Creek. It is located in Darby Township, Delaware County, Pennsylvania (Ref. 31, p.14 and Figure 1). An analysis of aerial photographs of the Clearview Landfill (Source 1) completed by EPA in November 1984 identified this source as a fill area located south of the Clearview Landfill south of Hook Road (Ref. 4, pp. 6 and 7; Ref. 31, p. 26). An aerial photography analysis of the Tinicum Marsh Environmental Center (currently John Heinz NWR) and surrounding areas identified the Industrial Drive Properties as Site 1 (Ref. 37, pp. III, 2, and 3). The properties were identified as an open dump (Ref. 37, p. 2). In 1953, the industrial drive properties were approximately 9 acres, with an impoundment located on the southwest corner of the property (Ref. 37, pp. 8 and 9). There also is evidence of open burning (Ref. 37, p. 8). In 1965, the properties are approximately 13.5 acres and the impoundment is filled and the entire area of the properties is capped and graded. Vehicle repair, storage, other service-based activities and a go-cart track are located on the properties (Ref. 37, p. 11). In 1973, the properties were 13.5 acres. Small commercial operations and large dump trucks and semi-tractors and trailers are located on the properties (Ref. 37, p. 15). In 1983, the properties are 12 acres. Heavy vehicular use is similar to that noted in previous years of photo coverage. Commercial operations continue. Much of the debris observed on the properties has been removed (Ref. 37, p. 19).

As of February 2000, the Industrial Drive properties included the following businesses: Atlas Recycling, American Sheet Metal, Lombardo Scrapyard/Fairview Hauling Ray's Truck Parts, Gricco's Garage, Bruce's Auto Body, Salerno Tire, and Bell Atlantic Mobile (cellular telephone tower) (Ref. 90, p. 1). During a May 1998 sampling event, one surface soil sample was collected near Darby Creek behind Gricco's Garage (Ref. 31, p. 18). In February 2000, six surface soil samples were collected from the Industrial Driver Properties (Ref. 90, p. 1, Table 1, p. 5, Figure 3, p. 8). Section 2.4.1 presents the concentrations of hazardous substances detected in the 1998 and 2000 samples.

Source Location:

Source 2 is located along Industrial Drive in Darby Township, adjacent to and west of Darby Creek and south of Hook Road and Clearview Landfill (Ref. 31, p. 14) (Figures 1 and 3).

Containment:

Release to Groundwater: The ground water pathway was not evaluated.

Release via overland migration and/or flood: Source 2 was identified as a dump area from an interpretation of aerial photographs completed by EPA. No maintained engineered cover or functioning and maintained runon control system and runoff management system were observed during the review of EPA aerial photographs or during site visits; therefore, a containment factor of 10 was assigned (Ref. 1, p. 51609; Ref. 4).

Gas Release to Air: The air migration pathway was not evaluated.

Particulate Release to Air: The air migration pathway was not evaluated.

A copy of Figure 3 is available at the EPA Headquarters Superfund Docket:

U.S. CERCLA Docket Office
Crystal Gateway #1, 1st Floor
1235 Jefferson Davis Highway
Arlington, VA 22202

Telephone: (703) 603-8917
E-Mail: superfund.docket@epa.gov

2.4.1 Hazardous Substances

One soil sample was collected at Source 2 during the 1998 EPA sampling event. A summary of hazardous substances detected in that sample is presented below. A background sample of surface soil was also collected and is presented below to document background concentrations of hazardous substances in soil. Both samples were collected between May 18 - 28, 1998 (Ref. 33, pp. Table 5a, page 2 of 3)

Table 3
Summary of Hazardous Substances Detected in Soil Sample from the
Industrial Drive Properties
1998 Site Inspection

Hazardous Substances	CRQL	Evidence	Concentrations	Background Concentration (DAR/SS-01/01A)	Reference
Organics (µg/kg)					
Naphthalene	330	CLF/SS-15	***410***	<330	31, pp. 18 and 20, Table 5c, p. 2 of 4, 9-B-39, and 9-B-36
2-Methylnaphthalene	330	CLF/SS-15	***710***	<330	31, pp. 18 and 20, Table 5c, p. 2 of 4, 9-B-39, and 9-B-36
Phenanthrene	330	CLF/SS-15	***1800***	570	31, pp. 18 and 20, Table 5c, p. 2 of 4, 9-B-39, and 9-B-36
Anthracene	330	CLF/SS-15	***390***	<330	31, pp. 18 and 20, Table 5c, p. 2 of 4, 9-B-39, and 9-B-36
Carbazole	330	CLF/SS-15	***330***	<330	31, pp. 18 and 20, Table 5c, p. 2 of 4, 9-B-39, and 9-B-36
Butylbenzylphthalate	330	CLF/SS-15	***1200***	<330	31, pp. 18 and 20, Table 5c, p. 2 of 4, 9-B-39, and 9-B-36
Chrysene	330	CLF/SS-15	***4300***	680	31, pp. 18 and 20, Table 5c, p. 2 of 4, 9-B-39, and 9-B-36
Benzo(k)fluoranthene	330	CLF/SS-15	***1600***	480	31, pp. 18 and 20, Table 5c, p. 2 of 4, 9-B-39, and 9-B-36
Indeno (1,2,3)pyrene	330	CLF/SS15	***2000***	300 J	33, pp. 18 and 20, Table 5c, p. 2 of 4, 9-B-39 and 9-B-36
Metals (mg/kg)					
Antimony	12	CLF/SS15	***18 L***	UL	31, pp. 18 and 20, Table 5a, pp. 1 of 3 and p. 2 of 3
Arsenic	2	CLF/SS15	***31.8***	6.6	31, pp. 18 and 20, Table 5a, pp. 1 of 3 and p. 2 of 3
Barium	40	CLF/SS15	***804***	138	31, pp. 18 and 20, Table 5a, pp. 1 of 3 and p. 2 of 3
Cadmium	1	CLF/SS15	***12.8***	0.23 B	31, pp. 18 and 20, Table 5a, pp. 1 of 3 and p. 2 of 3
Copper	5	CLF/SS15	***773 J***	76.1 J	31, pp. 18 and 20, Table 5a, pp. 1 of 3 and p. 2 of 3
Lead	0.6	CLF/SS15	***1580***	83.1	31, pp. 18 and 20, Table 5a, pp. 1 of 3 and p. 2 of 3
Nickel	8	CLF/SS15	***89.1***	19	31, pp. 18 and 20, Table 5a, pp. 1 of 3 and p. 2 of 3
Silver	2	CLF/SS15	***7.5***	0.27 L	31, pp. 18 and 20, Table 5a, pp. 1 of 3 and p. 2 of 3
Zinc	4	CLF/SS15	***2300***	349	31, pp. 18 and 20, Table 5a, pp. 1 of 3 and p. 2 of 3

Bold Concentration meets criteria for observed contamination, as set for in HRS Table 2-3 (Ref. 1) (three times background concentration, or detection with nondetect background), with consideration of data qualifiers (Ref. 33).
B Concentration not detected significantly above the level detected in the laboratory blank.
CRQL Contract Required Detection Limit.
J Estimated value. Reported value may not be accurate or precise.
L Analyte present. Reported value may be biased low.
* Background surface soil samples. SS01A is a duplicate of SS01. The highest concentration detected in either of the two samples is provided as the background concentration. Both samples are mislabeled as sediment samples (SD-01 and SD-01A) and appears as such in the laboratory data package (Ref. 31, p. 18).

2.4.1 Hazardous Substances

Six soil samples were collected at Source 2 during the February 2000 sampling event. Five of the six soil samples revealed concentrations of hazardous substances above background concentrations. A summary of hazardous substances detected above background in the samples are presented below. A background sample of surface soil was also collected and is presented below to document background concentrations of hazardous substances in soil (Ref. 90, Table 1, pp. 5 and 6and Figure 3, p. 8).

Table 4
Summary of Hazardous Substances Detected in Soil Sample from the Industrial Drive Properties
2000

Sample ID	CRDL	BKGRDND-SS-1	GAS-SS-1	DC-SS-1	DC-SS-4	BAM-SS-1	RPT-SS-1	RPT-SS-2
Location		Background	Gricco's Auto Service	West Bank Darby Creek, east of Gricco's Auto Service	West Bank Darby Creek, east of Bell Atlantic	Bell Atlantic Mobile	Ray's Truck Service	Ray's Truck Service
Reference		90, Table 1, p. 5; Figure 3, p. 8; App. F, pp. F-158 and F-167	90, Table 1, p. 5; Figure 3, p. 8; App. F, pp. F-59, F-62, and F-144	90, Table 1, p. 5; Figure 3, p. 8; App. F, pp. F-50, F-53 and F-142	90, Table 1, p. 5; Figure 3, p. 8; App. F, pp. F-56 and F-143	90, Table 1, p. 5; Figure 3, p. 8; App. F, pp. F-16 and F-133	90, Table 1, p. 5; Figure 3, p. 8; App. F, pp. F-65 and F-145	90, Table 1, p. 5; Figure 3, p. 8; App. F, pp. F-68 and F-146
Organics (µg/kg)								
Phenanthrene	330	420 U	***1200***	***8900 D***	***1400***	380 J	270 J	***660***
Anthracene	330	420 U	280 J	***2200 DL***	250 J	120 J	100 J	220 J
Carbazole	330	420 U	340 J	***1800 DJ***	270 J	99 J	56 J	120 J
Fluoranthene	330	420 U	***4400 D***	***33000 D***	***1900***	***1200***	***690***	***1300***
Pyrene	330	52 J	***3900 D***	***29000 D***	***1700***	***1200***	***670***	***1100***
Butyl benzyl phthalate	330	420 U	770	***4400 DJ***	380 U	420 U	210 J	140 J
Benzo(a)anthracene	330	420 U	***2800***	***18000 D***	***930***	***800***	***510***	***770***
Chrysene	330	420 U	***3100 D***	***23000 D***	***1000***	***1100***	***530***	***800***
Benzo(b)flouranthene	330	420 U	***3300 D***	***35000 J***	***1000***	***1400***	***660***	***1100 J***
Benzo(k)flouranthene	330	420 U	***2600 D***	***32000 J***	***720***	***1300***	***530***	***1200 J***
Benzo(a)pyrene	330	420 U	***3100 D***	***22000 D***	***870***	***1300***	***580***	***710***
Indeno(1,2,3-cd) pyrene	330	420 U	***2900***	***18000 D***	***700***	***1200***	***500***	***590***
Dibenzo(a,h) anthracene	330	420 U	***1100***	***7800 D***	310 J	***530***	230 J	300 J
Benzo(g,h,i)perylene	330	420 U	***2400***	***18000 D***	***570***	***1000***	420 J	***890***
Metals (mg/kg)								
Aluminum	40	3420	***17200***	***11800***	8810	***11300***	8310	8360
Arsenic	2	2.8	***41.6***	***189***	2.2 UJ	5.7	***19.9***	***17.7***
Barium	40	26.9 J	***1340 J***	***573 J***	***102 J***	***149 J***	***665 J***	***777 J***
Cadmium	1	0.29 J	***34.2***	***6.1***	0.6	***1.4***	***5.1***	***6.3***
Chromium	2	9.3	***81.8***	***61.1***	30.4	26.3	***53.5***	***46.7***

Table 4 (Continued)
Summary of Hazardous Substances Detected in Soil Sample from the Industrial Drive Properties
2000

Sample ID	CRDL	BKGRDND-SS-1	GAS-SS-1	DC-SS-1	DC-SS-4	BAM-SS-1	RPT-SS-1	RPT-SS-2
Location		**Background**	**Gricco's Auto Service**	**West Bank Darby Creek, east of Gricco's Auto Service**	**West Bank Darby Creek, east of Bell Atlantic**	**Bell Atlantic Mobile**	**Ray's Truck Service**	**Ray's Truck Service**
Reference		90, Table 1, p. 5; Figure 3, p. 8; App. F, pp. F-158 and F-167	90, Table 1, p. 5; Figure 3, p. 8; App. F, pp. F-59, F-62, and F-144	90, Table 1, p. 5; Figure 3, p. 8; App. F, pp. F-50, F-53 and F-142	90, Table 1, p. 5; Figure 3, p. 8; App. F, pp. F-56 and F-143	90, Table 1, p. 5; Figure 3, p. 8; App. F, pp. F-16 and F-133	90, Table 1, p. 5; Figure 3, p. 8; App. F, pp. F-65 and F-145	90, Table 1, p. 5; Figure 3, p. 8; App. F, pp. F-68 and F-146
Cobalt	10	3.6 J	***14.4***	***13.5***	6.4	6.2	9.7	8.5
Copper	5	8.8	***2840 J***	***897 J***	35.4 J	***69.9 J***	***424 J***	***347 J***
Cyanide	0.5	0.13 UJ	1 UJ	0.71 UJ	0.12 UJ	0.25 UJ	0.88 UJ	0.22 UJ
Iron	20	8140	***86700 J***	***71300 J***	15700	23400 J	***63400 J***	***45100 J***
Lead	0.6	28	***2690 J***	***6920 J***	***85 J***	***151 J***	***2620 J***	***1020 J***
Magnesium	1000	1160 J	***4970***	***4420***	***4050***	***20800***	***3860***	***4290***
Manganese	3	206	***753 J***	***622 J***	210 J	344 J	459 J	422 J
Mercury	0.1	112 UJ	***0.66***	***0.46***	0.11 UJ	0.24	***0.80***	***0.81***
Nickel	8	7.4 J	***83.6***	***213***	15.6	20.7	***63.1***	***42.7***
Selenium	1	0.59 U	0.83 J	0.55 U	0.52 U	0.57 U	1.7	0.8 J
Silver	2	0.15 U	***10.2***	***9.2***	0.14 U	0.28 J	***2.9***	1.9 J
Zinc	4	47.5	***5420***	***1220***	***167***	***259***	***1430***	***1380***

Bold Concentration meets criteria for observed contamination, as set for in HRS Table 2-3 (Ref. 1) (three times background concentration, or detection with nondetect background), with consideration of data qualifiers (Ref. 33).
B Not detected significantly above the level detected in the laboratory blank.
CRDL Contract Required Detection Limit
D Value reported for diluted sample.
J Estimated value. Reported value may not be accurate or precise.
U Not detected above the detection limit.

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

Information available is not sufficient to adequately support the evaluation of the hazardous constituent quantity for Source 2.

Sum (pounds): Unknown
Hazardous Constituent Quantity Value (C): NA

2.4.2.1.2 Hazardous Waste Stream Quantity

Information available is not sufficient to adequately support the evaluation of the hazardous waste stream for Source 2.

Sum (pounds): Unknown
Hazardous Waste Stream Quantity Value: NA

2.4.2.1.3 Volume

Information available is not sufficient to adequately support the evaluation of the volume for Source 2.

Dimension of source (yd^3 or gallons): Unknown
Volume Assigned Value: NA

2.4.2.1.4 Area

Information currently available is not sufficient to reliably support documentation of the area of Source 2. Figures showing the location of contaminated samples collected from the source are not to scale. Because hazardous substances have been detected at Source 2 at multiple locations the area has been assigned conservatively a value of greater than zero.

Area of source (ft^2): >0
Area Assigned Value: >0

2.4.2.1.5 Source Hazardous Waste Quantity Value

Hazardous substances have been detected at Source 2; however, the information available is not sufficient to support determination of a HWQ; therefore, a value of greater than zero has been assigned.

Source Hazardous Waste Quantity Value: >0

SOURCE DESCRIPTION

2.2 Source Characterization

Source Number: 3

HRS Source Type: Landfill

Source Description: Oily Sludge Disposal Area

This source is one of two sources located on the Sun Oil - Darby Creek Tank Farm at Calcon Hook and Hook Roads in Darby Township, Delaware County, Pennsylvania (Figure 1). The tank farm has been operational since the early 1950s. At that time, the tank farm was operated by Gulf Oil. In 1985, Chevron Corporation and Gulf Oil merged, and the tank farm subsequently was operated by Chevron Corporation (Ref. 74, p. 2-5). The Sun Oil Company purchased the Chevron Corporation Refinery in the Lower Darby Creek Area in 1994 which included the Darby Creek Tank Farm (Ref. 3).

Before the 1950s, the property was a gravel quarry. According to available information, the primary method of filling the excavated and low-lying areas created during quarry activities was the deposition of waste materials in them generated from the Gulf Oil Refinery located on the eastern bank of the Schuykill River (Ref. 74, pp. 2-5 and 4-1; Ref. 73, p. 1 and 2). According to the EPA Notification of Hazardous Waste Site submitted by Gulf Oil Corporation in 1981, records maintained by Gulf Oil document that wastes were landfilled at three locations at the facility from 1963 until 1967; however, employees have indicated that wastes were disposed of on the property from as early as 1950 (Ref. 72, pp. 2, 7, and 9). The process wastes disposed of at the three sources reportedly consisted of: heavy metals (RCRA waste type K052); acids; bases; oily solids (K049 and K051), miscellaneous salts; catalysts (containing vanadium, platinum, and palladium); and aluminum chloride (Ref. 72, pp. 1, 4, and 11).

Source 3 is located in the eastern portion of the Darby Creek Tank Farm (Figures 1 and 4). This location was used primarily for the disposal of oily dirt generated at the refinery, as well as various refinery catalysts. Metal wastes, such as refrigerators, reportedly also were landfilled there (Ref. 73, p. 2; Ref. 75, p. 1; Ref. 74, p. 2-5).

The information that documents the amount of waste disposed of at the facility indicates that 800 tons of process wastes were disposed of in the three locations, but does not identify the volume of waste disposed of in each area; therefore, the exact amount of waste disposed of at Source 3 is not known at this time (Ref. 72, pp. 7 and 9).

Source Location:

Source 3 is located in the eastern portion of the Darby Creek Tank Farm (Figure 4).

A copy of Figure 4 is available at the EPA Headquarters Superfund Docket:

U.S. CERCLA Docket Office
Crystal Gateway #1, 1st Floor
1235 Jefferson Davis Highway
Arlington, VA 22202

Telephone: (703) 603-8917
E-Mail: superfund.docket@epa.gov

Containment:

Release to Groundwater: The ground water pathway was not evaluated.

Release via overland migration and/or flood: No maintained engineered cover or functioning and maintained runon control system and runoff management system are documented to exist at Source 3. Therefore, a containment factor of 10 was assigned (Ref. 1, p. 51609; Ref. 74, pp. 2-5, 2-6, and 3-2).

Gas Release to Air: The air migration pathway was not evaluated.

Particulate Release to Air: The air migration pathway was not evaluated.

2.4.1 Hazardous Substances

One soil sample (S-3) was collected from the area during an EPA SI completed at the tank farm in 1986 (Ref. 74, Table 5-3, p. 5-3). The sample was analyzed under EPA's CLP for VOCs, PAHs, pesticides, PCB, total metals, and cyanide (Ref. 74, pp. 7-2 and 7-10). The hazardous substances detected in the soil sample are shown in the table below. A background soil sample (S-0) also collected during the SI is shown in the table to document concentrations of the various substances in soils in the area. All concentrations cited for soil sample S-3 exceed three times the background concentration.

TABLE 5
HAZARDOUS SUBSTANCES IN SOIL SAMPLE FROM THE OILY SLUDGE DISPOSAL AREA

Hazardous Substances	CRQL	Evidence	Concentration (μg/kg)	Background Concentration (S-0) (μg/kg)	Reference
Fluorene	10	S-3	***900 L***	<10	74, pp. 7-9e and 7-9k
Phenanthrene	10	S-3	***840 L***	<10	74, pp. 7-9e and 7-9k
Anthracene	10	S-3	***430 L***	<10	74, pp. 7-9e and 7-9k
Fluoranthene	10	S-3	***1,500 L***	88J	74, pp. 7-9e and 7-9k
Pyrene	10	S-3	***3,800 L***	91J	74, pp. 7-9e and 7-9k
Chrysene	10	S-3	***3,000 L***	<10	74, pp. 7-9e and 7-9k
Benzo(b)fluoranthene	10	S-3	***1,500 L***	<10	74, pp. 7-9e and 7-9k
Benzo(a)pyrene	10	S-3	***1,600 L***	<10	74, pp. 7-9e and 7-9k
Benzo(g,h,i)perylene	10	S-3	***1,500 L***	<10	74, pp. 7-9e and 7-9k
Cobalt	5	S-3	***90.10***	7.3	74, p. 7-9g
Copper	3.1	S-3	***120.00***	24.10	74, p. 7-9g
Mercury	0.20	S-3	***2.50***	<0.20	74, p. 7-9g
Nickel	8.10	S-3	***71.0***	13.8B	74, p. 7-9g
Vanadium	5	S-3	***215.0***	40.60	74, p. 7-9g
Zinc	4.5	S-3	***273.0***	62.30	74, p. 7-9g

Bold Concentration meets criteria for observed contamination, as set for in HRS Table 2-3 (Ref. 1), (three times background concentration, or detection with nondetect background), with consideration of data qualifiers (Ref. 33).
CRQL Contract Required Quantitation Limit.
J Estimated value. Reported value may not be accurate or precise.
L Anatyle present. Reported value may be biased low. Actual value is expected to be higher.
μg/kg Microgram per kilogram

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

The information available is not sufficient to adequately support the evaluation of the hazardous constituent quantity for Source 3.

Sum (pounds): Unknown
Hazardous Constituent Quantity Value (C): NA

2.4.2.1.2 Hazardous Waste Stream Quantity

Information available is not sufficient to adequately support the evaluation of the hazardous waste stream for Source 3.

Sum (pounds): Unknown
Hazardous Waste Stream Quantity Value: NA

2.4.2.1.3 Volume

Information available is not sufficient to adequately support the evaluation of the volume for Source 3.

Dimension of source (yd^3 or gallons): Unknown
Volume Assigned Value: NA

2.4.2.1.4 Area

The available scaled figures indicate that the area of Source 3 is approximately 285,490 ft^2. That area was calculated using AutoCAD Release 14 computer program and a scaled drawing (Ref. 75, p. 22; Ref. 76). The area divisor for determining the HWQ value assigned to a landfill is 3,400 (Ref. 1, p. 51591). The calculation of the HWQ value on the basis of the area of Source 3 is 285,490/3,400 with the result a value of 83.97.

Area of (ft^2): 285,490
Area Assigned Value: 83.97

2.4.2.1.5 Source Hazardous Waste Quantity Value

The source HWQ value for Source 3 is assigned the value for the area of the landfill (Ref. 1, p. 51591).

Source Hazardous Waste Quantity Value: 83.97

SOURCE DESCRIPTION

2.2 Source Characterization

Source Number: 4

HRS Source Type: Landfill

Source Description: Catalyst Disposal Area

This source is the second source located at the Sun Oil-Darby Creek Tank Farm at Calcon Hook and Hook Roads in Darby Township, Delaware County, Pennsylvania (Figure 1). See the source description section for Source 3 for further information about the processes that took place on the property.

According to available reports, Source 4 was a basin or pond that was filled primarily with catalysts contaminated with acid (Ref. 74, pp. 2-5 and 4-1; Ref. 72, pp. 2 and 9; Ref. 73, p. 1). The information that documents the amount of waste disposed of at the facility indicates that 800 tons of process wastes were disposed of in the three locations, but does not identify the volume of waste disposed of in each area; therefore, the exact amount of waste disposed of at Source 4 is not known at this time (Ref. 72, pp. 7 and 9).

Source Location:

Source 4 is located in the central portion of the facility along the western location approximately 135 feet west of Darby Creek (Ref. 75, p. 21 and Figure 4).

Containment:

Release to Groundwater: The ground water pathway was not evaluated.

Release via overland migration and/or flood: No maintained engineered cover documented on functioning and maintained runon control system and runoff management system are documented to exist at Source 4. Therefore, a containment factor of 10 was assigned (Ref. 1, p. 51609; Ref. 74, pp. 2-5, 2-6, and 3-2).

Gas Release to Air: The air migration pathway was not evaluated.

Particulate Release to Air: The air migration pathway was not evaluated.

2.4.1 Hazardous Substances

In March 1986, Chevron Corporation's environmental consultant collected soil samples at Source 4. The samples were collected to a depth of five feet. The analysis revealed concentrations of lead of 52 and 83 parts per million (ppm), at Source 4 (Ref. 74, p. 2-6). Four soil samples were collected at Source 4 in 1989 during an SI conducted by EPA Region 3 (Ref. 74, pp. 5-1 and 5-3). Those samples were analyzed under EPA's Contract Laboratory Program (CLP) for VOCs, PAHs, pesticides, PCBs, total metals, and cyanide (Ref. 74, pp. 7-2 and 7-10). Hazardous substances detected in the soils at Source 4 are shown in the table below. A background sample (S-0) collected at the same time as the source samples also is included in the table to document levels of the various substances in soils in the area. All concentrations cited for the soil samples exceed three times the background concentration.

TABLE 6
SITE INSPECTION HAZARDOUS SUBSTANCES DETECTED IN SOIL SAMPLES FROM THE CATALYST DISPOSAL AREA

Hazardous Substances	Evidence	CRQL	Concentrations	Background Concentration (S-0)	Reference
Organics (µg/kg)					
Phenanthrene	S-2	10	***3,400 J***	<330	35; 74, pp. 7-9e and 7-9 k
Benzo(k)fluoranthene	S-1	10	***990 N***	<330	35; 74, pp. 7-9e and 7-9 k
Benzo(a)pyrene	S-5	10	***780 N***	<330	35; 74, pp. 7-9e and 7-9 k
Benzo(g,h,i)penylene	S-4	10	***450 L***	<330	35; 74, pp. 7-9e and 7-9 k
Metals (mg/kg)					
Arsenic	S-1	1.6	***29.9***	5.6	74, pp. 7-9g and 7-9k
Mercury	S-1	0.2	***3.1***	<0.2	74, pp. 7-9g and 7-9k
	S-2		***1.2***		
	S-4		***2.7***		

Notes:

J	Estimated value. Reported value may not be accurate of precise.
CRQL	Contract Required Quantitation Limit.
L	Analyte present. Reported value may be biased low. Actual value is expected to be higher.
mg/kg	Milligram per kilogram
N	Tentative identification. Consider present.
µg/kg	Microgram per kilogram

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

The information available is not sufficient to adequately support the evaluation of the hazardous constituent quantity for Source 4.

Sum (pounds): Unknown
Hazardous Constituent Quantity Value (C): NA

2.4.2.1.2 Hazardous Waste Stream Quantity

The information available is not sufficient to adequately support the evaluation of the hazardous waste stream for Source 4.

Sum (pounds): Unknown
Hazardous Waste Stream Quantity Value: NA

2.4.2.1.3 Volume

The information available is not sufficient to adequately support the evaluation of the volume for Source 4.

Dimension of source (yd^3 or gallons): Unknown
Volume Assigned Value: NA

2.4.2.1.4 Area

The available scaled figures indicate that the area of Source 4 is approximately 25,874.2 ft^2. That area was calculated using the AutoCAD Release 14 computer program and a scaled drawing (Ref. 75, p. 22 and Ref. 76). The area divisor for determining the HWQ value assigned to a landfill is 3,400 (Ref. 1, p. 51591). The calculation of the HWQ value on the basis of the area of Source 4 is 25,874.2/3,400, resulting in a HWQ value of 7.61.

Area of source (ft^2): 25,874.2
Area Assigned Value: 7.61

2.4.2.1.5 Source Hazardous Waste Quantity Value

The source HWQ value for Source 4 is assigned the value for the area of the landfill.

Source Hazardous Waste Quantity Value: 7.61

SOURCE DESCRIPTION

2.2 Source Characterization

Source Number: 5

HRS Source Type: Contaminated Soil

Source Description: Sewage Sludge Disposal Area

The Sewage Sludge Disposal Area was located at the former Delaware County Sewage Treatment Plant in Darby Township, Delaware County, Pennsylvania, on the east side of Calcon Hook Road directly across from the former Delaware County Incinerator Landfill (Source 6) (Ref. 31, p. 9 and Figures 1 and 5). Darby Creek flows along the eastern and southern edges of the source. Before 1974, the source was used for the disposal of primary treatment sludge, which was dewatered and dried in sludge drying beds (Ref. 31, pp. 9-10). The sewage treatment plant operated from the 1950s until it closed at some time between 1972 and 1974. The plant discharged directly to Darby Creek (Ref. 31, p. 9). Aerial photographs show sewage sludge disposal activity being carried out in 1958 in a wetland area to the south of the treatment plant (Ref. 37, pp. 24 to 25). According to a representative of the Delaware County Sewage Treatment Plant, sewage sludge was taken from the drying beds and disposed of in an area adjacent to the drying beds on the southern section of the property toward Route 291, the sewage sludge disposal area. The sewage sludge never was removed and probably has become overgrown with vegetation. When the sewage sludge drying beds (concrete structures) were closed, the sewage sludge was disposed of off site (Ref. 86).

According to observations made during the EPA 1998 sampling event, the former Delaware County Sewage Treatment Plant currently is used only as a pumping station, and the settling tanks and lagoons have been closed and partially filled in (Ref. 31, p. 9). In February 2000 a sampling investigation of the sewage treatment plant was conducted. Samples were collected from a primary filter (filter 2) and an intermediate settling tank. Those samples were collected to identify possible constituents of the sewage sludge disposed of in the sewage sludge disposal area. The primary filter and the intermediate settling tank were processes involved in the generation of the sewage sludge. Samples collected from the intermediate settling tank (STP-SD-1and STP-SD-2) revealed PAHs, Aroclor 1260, and metals (Ref. 90, Table 1, pp. 5 and 6; Figure 4, p. 9; Table 4, pp. 14 and 15; Table 7, p. 20; and Table 10, p. 23). The sample collected from the primary filter 2 (STP-SD-4) revealed PAHs, Aroclor 1260, and metals (Ref. 90, Table 1, pp. 5 and 6; Figure 4, p. 9; and Appendix F, pp. F-79, F-80, F-126, and F-171). The presence of these hazardous substances in areas (structures) where wastewater was managed indicates that these substances may have been present in the water treated at the plant and may be contained in the sewage sludge disposed on the plant property. These substances were also detected in the sewage sludge as documented below.

During the February 2000 sampling investigation, samples were also collected from the sewage sludge disposal area (STP-SS-1 and STP-SS-2) (Ref. 90, Table 1, p. 6 and Figure 4, p. 9). The samples revealed the presence of PAHs, Aroclor 1260, and metals (Ref. 90, Table 1, p. 6; Figure 4, p. 9; Table 3, pp. 12 and 13; Table 6, p. 18; and Table 9, p. 22).

Source Location:

The sludge beds are located at the former Delaware County Sewage Treatment Plant situated east of Calcon Hook Road in Darby Township, Delaware County, Pennsylvania directly across from the former Delaware County Incinerator Landfill (Source 6) (Ref. 31, p. 9 and Figures 1 and 5).

A copy of Figure 5 is available at the EPA Headquarters Superfund Docket:

U.S. CERCLA Docket Office
Crystal Gateway #1, 1st Floor
1235 Jefferson Davis Highway
Arlington, VA 22202

Telephone: (703) 603-8917
E-Mail: superfund.docket@epa.gov

Containment:

Release to Groundwater: The ground water migration pathway was not evaluated.

Release via Overland Migration/Flood: There is no evidence of hazardous substance migration from the source area. However, neither of the following is present: (1) maintained engineered cover, or (2) functioning and maintained runon control system and runoff management system (Ref. 31, p. 9). In addition, aerial photographs indicate that disposal activity at the source began in approximately 1958 with the dumping of material in a wetland area just south of the treatment plant (Ref. 37, pp. 24-25). Therefore, a surface-water containment factor of 10 was assigned (Ref. 1, p. 51609).

Gas Release to Air: The air migration pathway was not evaluated.

Particulate Release to Air: The air migration pathway was not evaluated.

2.4.1 Hazardous Substances

Two soil samples were collected at Source 5 during the February 2000 sampling event. A summary of hazardous substances detected above background in the samples are presented below. A background sample of surface soil was also collected and is presented below to document background concentrations of hazardous substances in soil (Ref. 90, Table 1, p. 6 and Figure 4, p. 9). The hazardous substances detected in the soil sample collected from the Sewage Sludge Disposal Area were also detected in samples obtained from primary filter 2 and the intermediate settling tank (Ref. 90, Table 1, pp. 5 and 6; Table 4, pp. 14 amd 15; Table 7, p. 20; and Table 10, p. 23). This indicates that these substances may have been contained in wastewater treated in the sewage treatment plant and in the sewage sludge generated from the treatment of that wastewater.

Table 7
Summary of Hazardous Substances Detected in Soil Sample from the Sewage Sludge Disposal Area
February 2000

Sample ID	CRDL	BKGRDND-SS-1	STP-SS-01	STP-SS-2
Location		Background	Sewage Sludge Disposal Area	Duplicate of STP-SS-02
Reference		90, Table 1, p. 5; Figure 3, p. 8; and App. F, pp. F-158 and F-167	90, Table 1, p. 6; Figure 4, p. 9; and App. F, pp. F-83, F-86, F-127, and F-172	90, Table 1, p. 6; Figure 4, p. 9; and App. F, pp. F-89, F-92, F-129, and F-173
Organics (µg/kg)				
Phenanthrene	330	420 U	***4200***	***3900***
Anthracene	330	420 U	***810***	***620***
Carbazole	330	420 U	***570***	430J
Fluoranthene	330	420 U	***5700 D***	***6200 D***
Pyrene	330	52 J	***4100 D***	***4800 D***
Benzo(a)anthracene	330	420 U	***3100***	***2600***
Chrysene	330	420 U	***3900***	***3200***
Benzo(b)flouranthene	330	420 U	***2000 D***	***2500***
Benzo(k)flouranthene	330	420 U	***2700 D***	***2700***
Benzo(a)pyrene	330	420 U	***2800***	***2600***
Indeno(1,2,3-cd) pyrene	330	420 U	***2300***	***2000***
Dibenzo(a,h) anthracene	330	420 U	***860***	***760***
Benzo(g,h,i)perylene	330	420 U	***1900***	***1600***
Polychlorinated Biphenyls (µg/L)				
Aroclor-1260	33	42 U	***250 J***	***180 J***
Metals (mg/kg)				
Aluminum	40	3420	18600	17400

Table 7
Summary of Hazardous Substances Detected in Soil Sample from the Sewage Sludge Disposal Area
February 2000

Sample ID	CRDL	BKGRDND-SS-1	STP-SS-01	STP-SS-2
Location		Background	Sewage Sludge Disposal Area	Duplicate of STP-SS-02
Reference		90, Table 1, p. 5; Figure 3, p. 8; and App. F, pp. F-158 and F-167	90, Table 1, p. 6; Figure 4, p. 9; and App. F, pp. F-83, F-86, F-127, and F-172	90, Table 1, p. 6; Figure 4, p. 9; and App. F, pp. F-89, F-92, F-129, and F-173
Barium	40	26.9 B	***278 J***	***241 J***
Cadmium	1	0.29 B	***7.7***	***7***
Chromium	2	9.3	***92.7***	***79.7***
Copper	5	8.8	***162 J***	***149 J***
Iron	20	8140	***29100 J***	***27300 J***
Lead	0.6	28	***199 J***	***183 J***
Magnesium	1000	1160 B	***7690***	***7340***
Mercury	0.1	U	***0.52***	***0.57***
Nickel	8	7.4 B	***45.5***	***42.5***
Silver	2	0.15 U	***4.8***	3.9
Vanadium	10	9.5 B	***55.9***	***53.7***
Zinc	4	47.5	***478***	***450***

Bold	Concentration meets criteria for observed contamination, as set for in HRS Table 2-3 (Ref. 1), (three times background concentration, or detection with nondetect background), with consideration of data qualifiers (Ref. 33).
B	Not detected significantly above the level detected in the laboratory blank.
CRDL	Contract Required Detection Limit.
D	Value reported for diluted sample.
J	Estimated value. Reported value may not be accurate or precise.
U	Not detected above the detection limit.

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

The information available is not sufficient to adequately support the evaluation of the hazardous constituent quantity for Source 5.

Sum (pounds): Unknown
Hazardous Constituent Quantity Value (C): NA

2.4.2.1.2 Hazardous Waste Stream Quantity

The information available is not sufficient to adequately support the evaluation of the hazardous waste stream for Source 5.

Sum (pounds): Unknown
Hazardous Waste Stream Quantity Value: NA

2.4.2.1.3 Volume

The information available is not sufficient to adequately support the evaluation of the volume for Source 5.

Dimension of source (yd^3 or gallons): Unknown
Volume Assigned Value: NA

2.2.2.1.4 Area

According to aerial photographs, the area of this source is estimated to be 3.5 acres (Ref. 31, p. 9; Ref. 37, pp. 31 and 33). Soil samples from the sewage sludge disposal area indicate that the source is contaminated soil (Ref. 90. Table 1, pp. 5 and 6 and Figure 4, p. 9 and Table 7 of this documentation record). The area of the contaminated soil is estimated to be the size of the area observed on the aerial photographs 3.5 acres (Ref. 31, p. 9; Ref. 37, pp. 31and 33). The area in ft^2 is 3.5 acres x 43,560 ft^2/acre = 152,460 ft^2. The area divisor for determining the HWQ value assigned to contaminated soil is 3,400 (Ref. 1, p. 51591). The calculation of the HWQ value on the basis of the area of the source is: 152,460/34,000 = 4.48

Area of Source (ft^2): 152,460
Reference(s): 1, p. 51591; 31, p. 9; 37, pp. 31, 33
Area Assigned Value: 4.48

2.2.2.1.5 Source Hazardous Waste Quantity Value

The HWQ value for this source is based on an area of 3.5 acres. The assigned value of the source is determined from HRS Table 2-5 (Ref. 1, p. 51591).

Source Hazardous Waste Quantity Value: 4.48

SOURCE DESCRIPTION

2.2 Source Characterization

Source Number: 6

HRS Source Type: Landfill

Source Description: Former Delaware County Incinerator Landfill

The former Delaware County Incinerator Landfill is located near the intersection of Calcon Hook Road and Tribbett Avenue in Darby Township and Folcroft Borough, Delaware County, Pennsylvania (Ref. 31, p. 6; Ref. 32, p. 2 and Figures 1 and 6). The landfill covers approximately 15 acres and was used for the disposal of ash and residue generated from the incinerator between the mid-1960s and 1971. The incinerator was owned and operated by Delaware County and reportedly handled approximately 500 to 800 tons of refuse per day (Ref. 31, pp. 6-7; 32, p. 2). Before the disposal activities took place, portions of the property were wetland or marsh areas (Ref. 31, p. 6; Ref. 32, p. 2). The landfill is bordered on the west by Hermesprota Creek (Ref. 31, pp. 7-8; Ref. 32, p. 2).

Observations made during the EPA 1998 sampling event indicated that the landfill area was being covered with additional soil in preparation for development of a canine training area. The former incinerator stack was demolished. The Delaware County Emergency Services Training Center currently uses the property (Ref. 31, pp. 7-9).

A copy of Figure 6 is available at the EPA Headquarters Superfund Docket:

U.S. CERCLA Docket Office
Crystal Gateway #1, 1st Floor
1235 Jefferson Davis Highway
Arlington, VA 22202

Telephone: (703) 603-8917
E-Mail: superfund.docket@epa.gov

Source Location:

The former Delaware County Incinerator Landfill is situated near the intersection of Calcon Hook Road and Tribbett Road in Darby Township and Folcroft Borough, Delaware County, Pennsylvania (Ref. 31, p. 6; Ref. 32, p. 2) (Figure 6).

Containment:

Gas Release to Air: The air migration pathway was not evaluated.

Particulate Release to Air: The air migration pathway was not evaluated.

Release to Groundwater: The ground water migration pathway was not evaluated.

Release via Overland Migration/Flood: There is no evidence of hazardous substance migration from the source area. However, neither of the following is present: (1) maintained engineered cover, or (2) functioning and maintained run-on control system and runoff management system (Ref. 31, pp. 6-9; Ref. 32, pp. 2-4). In addition, evidence indicates that Hermesprota Creek, which flows along the western edge of the landfill, has eroded the banks of the landfill (Ref. 32, pp. 3-4). Therefore, a surface-water containment factor of 10 was assigned (Ref. 1, p. 51609).

2.2.1 Hazardous Substances

EPA collected six subsurface soil samples from the source during the 1998 sampling event. The samples were analyzed for TCL organics compounds, TAL inorganics compounds, and dioxin (Ref. 31, pp. 17, 21-22). Background samples used for the comparison of data for the samples identified above include samples DAR/SS-01 and DAR/SS-01A, collected from a location near Darby Creek (Ref. 31, pp. 18 and Figure 6). Figure 6 shows the locations from which the samples were collected. Table 8 summarizes the concentration of hazardous substances detected in the samples.

TABLE 8
CONCENTRATION OF HAZARDOUS SUBSTANCES DETECTED IN SOIL SAMPLES FROM THE INCINERATOR LANDFILL
1998 SITE INVESTIGATION

Hazardous Substance	CRDL	DAR/SS-01* (Background)	DAR/SS-01A* (Background)	DCI/WS-33A	DCI/WS-33B	DCI/WS-34A	DCI/WS-34B	DCI/WS-37A	DCI/WS-37B
CLP Sample No.		**MCSD18**	**MCSD19**	**MCSD30**	**MCSD31**	**MCSD28**	**MCSD29**	**MCSD35**	**MCSD34**
Reference		**31, p. 18; 83, Appendix B, p. 8; Appendix C, SDG MCSD01, p. 11**	**31, p. 18; 83, Appendix B, p. 9, Appendix C, SDG MCSD01, p. 12**	**31, p. 21; 83, Appendix B, p. 10, Appendix C, SDG MCSD28, p. 5**	**31, p. 21, Attachment 9D, Dioxin Data Validation, Appendix B, p. 2; Ref. 83, Appendix B, p. 10, Appendix C, SDG MCSD28, p. 6**	**31, p. 22; 83, Appendix B, p. 10, Appendix C, SDG MCSD28, p. 3**	**31, p. 22, Attachment 9D, Dioxin Data Validation, p. 1; Ref. 83, Appendix B, p. 10, Appendix C, SDG MCSD28, p. 4**	**31, p. 22; 83, Appendix B, p. 10, Appendix C, SDG MCSD28, p. 10**	**31, p. 22, Attachment 9D, Dioxin Data Validation, Appendix B, p. 2; Ref. 83, Appendix B, p. 10, Appendix C, SDG MCSD28, p. 9**
Copper	5	71.5 J	76.1 J	79.1	232	6.9	**1,060**	20.1	77.1
Lead	0.6	75.7	83.1	318 J	38.9 J	3.9 B	29.8 J	17.6 B	509 J
Silver	2	UL	0.27 L	[1.1]	[0.43]	[0.51]	[0.54]	[0.33]	[1.1]
Dioxin (total) [a]	Various	NA	NA	NA	**3.15038**	NA	**2.33536**	NA	**48.52027**

[a] Concentration in pg/g; all other concentrations in mg/kg

BOLD Concentration meets criteria for observed release, set forth in HRS Table 2-3 (Ref. 1) (three time background concentrations or detection with a non-detect background), with consideration of data qualifiers (Ref. 33).
CRDL Contract Required Detection Limit
J Analyte present. Reported value may not be accurate or precise.
pg/g Picogram per gram
[ ] Analyte present as values approach the instrument detection limit the quantitation may not be accurate.
* This sample is mislabled as a sediment sample SD-01A, and appears as such in the laboratory data package (Ref. 31, p. 18)

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

The information available is not sufficient to adequately support the evaluation of the hazardous constituent quantity for Source 6.

Sum (pounds): Unknown
Hazardous Constituent Quantity Value (C): NA

2.4.2.1.2 Hazardous Waste Stream Quantity

The information available is not sufficient to adequately support the evaluation of the hazardous waste stream for Source 6.

Sum (pounds): Unknown
Hazardous Waste Stream Quantity Value: NA

2.4.2.1.3 Volume

The information available is not sufficient to adequately support the evaluation of the volume for Source 6.

Dimension of source (yd^3 or gallons): Unknown
Volume Assigned Value: NA

2.2.2.1.4 Area

The area of this source has been estimated to be 15 acres (Ref. 31, p. 6; Ref. 32, p. 2). The area of the landfill in ft^2 is 15 acres x 43,560 ft^2/acre = 653,400 ft^2. The area divisor for determining the HWQ value assigned to a landfill is 3,400 (Ref. 1, p. 51591). The calculation of the HWQ value on the basis of the area of the source is:

653,400/3,400 = 192.18

Area of Source (ft^2): 653,400
Reference(s): 1, p. 51591; 31, p. 6; 32, p. 2
Area Assigned Value: 192.18

2.2.2.1.5 Source Hazardous Waste Quantity Value

For Source 6, the former Delaware County Incinerator Landfill, the source HWQ value is based on an area of 15 acres. The assigned value of the source is determined from HRS Table 2-5 (Ref. 1, p. 51591).

Source Hazardous Waste Quantity Value: 192.18

SOURCE DESCRIPTION

2.2 Source Characterization

Source Number: 7

HRS Source Type: Landfill

Source Description: Folcroft Landfill and Annex

Source 7, the Folcroft Landfill and Annex, is now located within the 1,200-acre John Heinz NWR at Tinicum (formerly the Tinicum National Environmental Center). The refuge is located near the confluence of Darby Creek and the Delaware River (Figure 1). It was established by Congress in 1972 to preserve diverse fish and wildlife habitat for natural and educational purposes (Ref. 24, p. II-1; Ref. 49). In 1980, Congress authorized the U.S. Department of Interior (DOI) to purchase additional land to increase the size of the refuge. Included in that land acquisition was the 62-acre Folcroft Landfill and Annex (Ref. 36, p. I-1). More than 100,000 people visit the refuge to engage in hiking, bicycling, canoeing, fishing, bird watching, nature photography, environmental education, and other outdoor activities (Ref. 89).

The Folcroft Landfill is bordered by Darby Creek and Thoroughfare Creek on the east and southeast, Hermesprota Creek on the west, the closed Delaware County Incinerator and Delaware County Sewage Treatment plant on the north, and a tidal marsh on the southwest (Ref. 24, pp. II-3, III-1A; Ref 34). The annex is bordered by Hermesprota Creek on the east, a business park to the west, residential developments to the north, and the tidal marsh on the south (Ref. 34).

Folcroft Landfill and Annex are located at the highest elevation in the refuge. The landfills remain unaffected by the tidal fluctuations except for the base of the landfill where it borders the marsh and creeks. Folcroft Landfill slopes steeply along Darby Creek (on its east side) (Ref. 36, p. III-1).

In 1984, an aerial photography analysis of the Tinicum Marsh Environmental Center (now the John Heinz NWR) was completed for the periods 1953 to 1983. Photographs taken during the years 1953, 1958, 1964, 1965, 1971, 1973, 1975, and 1983 were analyzed.

The 1953 aerial photograph of the Folcroft Landfill shows disposal activities beginning in a 0.25-acre area at the southern end of Calcon Hook Road. The landfill was located on the bank of a marsh. Waste disposal operations appeared to move southeastward into the marsh (Ref. 37, p. 22).

Between 1958 and 1971, the Folcroft Landfill was expanded to 47.5 acres (Ref. 37, p. 31). The Folcroft Landfill Annex (site 11) appears in the 1971 aerial photograph and was 16.5 acres in size (Ref. 37, p. 32). The 1975 aerial photographs indicate that disposal operations at the Folcroft Landfill and Annex had ceased (Ref. 37, p. 37).

The historical photographic analysis of the Folcroft Landfill indicates that dumping began there as early as 1953. However, the landfill did not open officially until 1959 (Ref. 36, p. IV-4; Ref. 37, pp. 22 and 23). Dumping continued at Folcroft Landfill until 47.5 acres of wetlands had been filled and the Folcroft Landfill abutted Darby Creek, Thoroughfare Creek (a branch of Darby Creek), and Hermesprota Creek. In addition, 16-½ acres of wetlands located at the Folcroft Annex were filled (Ref. 24, p. II-3; Ref. 37, p. 33). The two landfills operated under PADER Solid Waste Permit Number 10053 and were permitted to accept municipal, demolition, and hospital wastes. Inspection reports prepared by staff of PADER indicate that the landfills were not used solely for municipal dumping. In 1973, the landfills were closed for permit violations and improper management. Closure activities began in 1974 under orders to regrade the landfill, eliminate the excessively steep slopes, eliminate fires, and cover refuse with fill. Cover allegedly was obtained from dredge soils from the construction for Interstate 95, and the Sun Oil Company refinery in Marcus Hook, Pennsylvania (Ref. 24, p. II-3; Ref. 36, p. IV-4). Cover material averaged two to four feet thick, with depths in some locations ranging up to 10 feet. The area was seeded with rye and fescue grasses; but good vegetative cover was not established on the eastern half of the Folcroft Landfill. Site inspection reports for closure note the lack of vegetation (Ref. 36, p. IV-5).

The Folcroft Landfill was owned by Mr. Wilbur C. Henderson and Hauling. The landfill was used for approximately 13 years and was closed in 1974. The 11-acre landfill annex was owned by Henderson-Columbia Corporation. In 1980, DOI purchased seven acres of that property to become part of the 1,200-acre John Heinz NWR. The Philadelphia Electric Company purchased and currently owns the remaining four acres (Ref. 20, p. 2-1).

Investigations

Numerous investigations have been conducted at the Folcroft Landfill and Annex. The subsections presented below provide summaries of the findings of each of those investigations.

Periodic Inspections - 1969 and 1973

The earliest known visual inspection of the Folcroft Landfill was performed on August 28, 1969, before the annex began operating. According to the inspector, the landfill received wastes from the Philadelphia Navy Yard, the Boeing Vertical Company, and the American Viscose Company (Ref. 50, p. 1). Subsequent potentially responsible parties (PRP) investigations identified those companies as PRPs (Ref. 23, pp. 13 to 15). During the inspection, oily sludge was being disposed of in an area south of the office building. Sewage sludge had been dumped on the east side of the landfill (Ref. 50, p. 1). On the west side of the landfill, refuse was being pushed directly into a swamp (Ref. 50, p. 2).

In 1970, a hydrogeological investigation of the landfill was conducted. According to the inspector, a loading dock located at the south end of a maintenance building extended to an inlet of Darby Creek. The inspector observed an oil-like material being discharged over the edge of the dock. Industrial wastes having an oily appearance were being disposed of on the surface of the landfill (Ref. 52, p. 1).

On the east side of the landfill refuse was being pushed into the water. Industrial waste consisting of oil-soaked fuller's earth and various green, lavender, white, and red materials, were being placed directly in the marsh on the southeast corner of the landfill. An excavation, 30 x 20 feet in dimensions, had been filled with black fluid to 4 feet below the surface of the ground. The inspector believed that the dark fluid was waste industrial oil (Ref. 52, p. 2). After the inspection, a notice of violation was issued to the owners of the landfill for placing industrial waste and refuse into waters of the Commonwealth without a valid permit (Ref. 51).

On October 5, 1972, a PADER inspection of the landfill was conducted. The inspector indicated that there was evidence of the dumping of liquids at the landfill (Ref. 53).

A PADER periodic inspection of the Folcroft Landfill was conducted on November 10, 1972. Hazardous liquid waste was found on the landfill. The inspector observed approximately 1,000 gallons of methyl-ethyl ketone (MEK) in 55-gallon drums. The drums were leaking, and the liquid was flowing toward Tinicum Marsh. Also located at the landfill were 20 unlabeled 55-gallon drums of liquids, sludges, and petroleum liquid and large amounts of barium oxide. All these wastes were reportedly located along the back edge of the landfill (probably the southwest section of the landfill). The inspectors noted a chemical odor and became nauseated (Ref. 22, p. 6.2-5).

On January 19, 1973, a second periodic inspection of the landfill by PADER was conducted. Several drums of assorted liquid wastes were found to have been deposited recently on the landfill (Ref. 22, p. 6.2-6) and sandblasting wastes were being used as clean fill in the landfill (Ref. 22, p. 6.2-8).

In May 1973 PADER collected samples from a ponded area, sludge, and a container observed on the landfill (Ref. 57 through 62). The analytical results from the analysis of the samples is provided in the table below.

TABLE 9
AQUEOUS AND WASTE SAMPLES COLLECTED FROM FOLCROFT LANDFILL - 1973

Sample Locations	Ponded Liquid Near Office	Liquid From Excavated Area	Ponded Liquid Adjacent to Access Road	Green Liquid From Can	Black Sludge on Current Work Area	Green Black Sludge on Old Work Area
Matrix	**Aqueous**	**Aqueous**	**Aqueous**	**Aqueous**	**Solid**	**Solid**
Sample Number	**679753**	**689754**	**689752**	**686505**	**686504**	**686503**
Inorganics (aqueous µg/L and solid mg/kg)						
Cadmium	NA	NA	NA	700	16	10
Copper	2,280	9,200	2,640	550	1,100	11,900
Chromium	340	920	320	1,050	580	187,000
Iron	540,000	1,140	388,000	12,400	30,360	84,400
Nickel	3,060	3,340	3,640	650	126	121
Zinc	9,000	79,000	5,200	138,000	22,700	131
Lead	6,700	13,600	440	177,000	1,200	150

Notes: Reference: 57 through 62 µg/L Microgram per liter
NA Not analyzed mg/kg Milligram per kilogram

Site Inspection - 1980

EPA consultants completed an on-site inspection, and sampling of the Folcroft Landfill was conducted on October 29, 1980. One sample of hazardous material, four soil samples, and seven water samples were collected from the landfill (Ref. 22, pp. 2-1 and 5-2). The results of the analysis of the samples could not be located. Smoke or vapor was emanating from the landfill during the inspection (Ref. 22, pp. 7 and 2-1). Leachate was flowing directly into Thoroughfare Creek (a branch of Darby Creek) and Hermesprota Creek (Ref. 22, pp. 12 and 2-2). The report on the on-site inspection indicated that E.I. Dupont de Nemours and Company and Rohm and Haas Company had disposed of waste in the landfill and that Tri-County Haulers transported waste to the landfill (Ref. 22, p. 2 of 10). However, subsequent PRP investigations did not identify those companies as PRPs (Ref. 23, pp. 13 to 15). The following wastes were identified in the report as having been disposed of in the landfill: oil wastes; halogenated solvents; aromatic polar and nonpolar compounds; acids; pesticides; metals; fly ash; asbestos; radioactive materials; municipal waste; hospital; and demolition waste (Ref. 22, pp. 4 of 10 and 6-1). It has not been determined how those wastes were identified.

Fire in Folcroft Landfill - 1983

On July 13, 1983, a grass fire occurred at the Folcroft Annex, allegedly caused by the catalytic converter of a vehicle parked over underbrush on the landfill. Eleven acres of the landfill burned (Ref. 44, p. 1). During the fire several drums were uncovered that contained a red, jelly-like substance that reacted with water (Ref. 44, p. 1; Ref. 24, p. II-3). During firefighting efforts, a number of those drums caught fire on contact with water (Ref. 44, p. 1). EPA Region 3 was notified and an immediate removal action was implemented (Ref. 44, pp. 1 and 2). Eight samples were taken from the drums and classified in terms of pH, flammability, reactivity, corrosivity, and pesticide content. Two samples from the drums were screened for metal content (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver). Soil, sediment, water, and air samples also were taken and screened for 44 contaminants (Ref. 24, p. II-3). No concentrations of pollutants were detected in air samples above the allowable limits for workplaces established by the American Conference of Governmental Industrial Hygienists (Ref. 44, p. XII-13).

According to EPA pollution reports (POLREPS) filed during the removal action, the contents of two of the drums were not hazardous, and those drums were disposed in the landfill. Six of the drums were overpacked and disposed at a hazardous waste disposal facility (Ref. 44, p. X-3). A newspaper article about the fire indicates that the drums contained toluene, xylene, ethylbenzene, and lead (Ref. 44, p. XI-6). The contents of the drums are described in a hazardous waste manifest as follows: (1) resin-flammable solid, 170 gallons, waste code D001 (a solid waste that exhibits the characteristic of ignitability); (2) flammable solids - flammable solid, 85 gallons, waste code D001; (3) water-soluble lead - waste soluble lead, 170 gallons, waste code D008 (lead concentration higher than 5.0 mg/L); and (4) asphalt - combustible solid, 85 gallons, waste code D001 (Ref. 45; Ref. 46, pp. 54 to 56).

A summary of the drum and soil samples collected during the removal action is provided in the table below.

TABLE 10
DRUM AND SOIL SAMPLES FROM FOLCROFT LANDFILL ANNEX - JULY 16 AND 18, 1983*

Sample ID	**2**	**3**	**7 and 8**	**9**	**S1**	**S2**
Sample Location	Drum	Drum	Drum	Drum	Soil	Soil
Inorganics (ppm)						
Arsenic	<.15	<.15	NA	NA	<.005	<.005
Barium	1.0	2.9	NA	NA	1.48	0.28
Cadmium	<.1	0.1	NA	NA	0.02	0.01
Chromium	0.15	0.6	NA	NA	0.09	0.01
Lead	3.1	12.3	NA	NA	0.53	3.08
Mercury	0.005	0.008	NA	NA	0.001	0.0015
Selenium	<.15	<.15	NA	NA	<.005	<.005
Silver	0.70	12.0	NA	NA	0.02	<.01
Organics (ppm)						
Naphthalene	<10	<10	<10	8,000	<10	<10
Acenaphthene	<10	<10	<10	3,870	<10	<10
Fluorene	<10	<10	<10	7,528	<10	<10
Phenanthrene	<10	<10	<10	8,000	<10	<10
Fluoranthene	<10	<10	<10	8,244	<10	<10
Pyrene	<10	<10	<10	12,713	<10	<10
Chrysene	<10	<10	<10	25,085	<10	<10
Benzofluoranthene	<10	<10	<10	11,794	<10	<10
Benzo(a)pyrene	<10	<10	<10	11,371	<10	<10
Indenopyrene	<10	<10	<10	2,512	<10	<10
Benzo(g,h,i) perylene	<10	<10	<10	1,636	<10	<10

Source: Reference 44, Section XII

* All compounds that are not listed were not detected: detection levels ranged from 10 to 100 ppm. All data are in ppm.

NA Not analyzed

ppm Parts per million

During firefighting activities, large quantities of illegally dumped hospital wastes were discovered throughout the surface of the landfill (Ref. 44, pp. 19 and X-4). EPA determined that the Folcroft Annex should be capped to adequately cover exposed surfaces, protecting the public health from direct contact with hospital wastes and drums (Ref. 44, p. 19). Six to eight inches of fly ash (filter cake), followed by 12 inches of compacted soil, were used to cap the landfill. The Philadelphia Electric Company supplied the fly ash, and its use was approved by PADEP (Ref. 44, pp. 3 and 6). The Philadelphia Electric Company provided to EPA analytical data that identified the contents of the filter cake (Ref. 47). By September 23, 1983, capping and hydroseeding of the entire landfill had been completed (Ref. 44, p. 25).

Also during firefighting activities, the bulldozer used to cover smoldering underground fires exposed drums that had been buried near the surface of the landfill. Several of the drums burst into flames when their contents were exposed to the atmosphere (Ref. 44, p. X-4).

An Investigation of Potential Environmental Hazards - 1986

In 1980, Congress authorized DOI to purchase the 62-acre Folcroft Landfill and Annex to increase the size of the John Heinz NWR (formerly Tinicum National Environmental Center). Because it had been alleged that hazardous wastes had been dumped at the landfills, Congress directed EPA, in coordination and consultation with the U.S. Fish and Wildlife Service (FWS), DOI, to investigate potential environmental health hazards resulting from the Folcroft Landfill and to develop alternative recommendations about how such hazards, if any, might best be addressed to ensure the protection of the refuge and the general public (Ref. 36, p. I-1). *An Investigation of Potential Environmental Hazards at Tinicum National Environmental Center* (currently John Heinz NWR), was prepared to identify whether Folcroft Landfill and Annex posed an environmental threat to the refuge (Ref. 36, p. I-1).

The investigation identified the Folcroft Landfill as a source of aluminum, cyanide, copper, lead, and zinc at the John Heinz NWR (referred to as "the Center" in the report) (Ref. 36, p. *i* and IV-7). The leachate from the landfill was described as containing levels of copper (190 parts per billion [ppb]), iron (3,030 ppb), lead (200 ppb), manganese (1,220 ppb), nickel (70 ppb), and zinc (1,090 ppb) that were determined to be toxic to laboratory organisms in bioassay tests (Ref. 36, pp. *i*, *ii* and p. IV-8, Table 6b). The report indicated that, in February 1986, EPA's Environmental Services Division collected and analyzed four samples from the Folcroft Landfill to screen for aquatic toxicity. (Ref. 36, p. IV-5). The investigation concluded that the Folcroft Landfill was a source of aluminum, cyanide, chromium, copper, and nickel contamination (chlordane also was identified; however, because that pesticide was in common use, that compound was not included in this discussion) (Ref. 36, pp. IV-16 and IV-28).

Site Inspection - 1988

In 1988, EPA and FWS conducted a joint site investigation as a follow-up to previous site investigations and sampling efforts that were conducted by EPA between October 1980 and February 1986. The site inspection included the collection of samples of soil, sediment, surface water and seeps, and ground water. The samples were analyzed for general physical and chemical parameters, Target Analyte List (TAL) metals, and Target Compound List (TCL) organic substances (Ref. 24, p. I-1). A discussion of the analytical results are presented in the sections below.

Surface Soil Analytical Results

Samples of soil samples from Folcroft Landfill and Annex were collected and analyzed for general chemical parameters, TAL metals, and TCL organic compounds (Ref. 24, p. III-2). Figure 7 shows the locations from which the samples were collected. Eight of the nine samples of surface soil were composites of five grab samples collected within 100 feet of one another in a grid-type pattern. Surface soil sample ASL was a single-grab sample, rather than a composite. The composite samples were composited from a depth of 0 to 12 inches (Ref. 24, p. III-4). Table 10 below provides a summary of substances detected at concentrations equal to or higher than three times the background level.

As Table 10 shows, the samples of surface soil collected from Folcroft Landfill and Annex document the presence of the following contaminants in surface soil at concentrations equal to or higher than three times the background level: acenaphthene; anthracene; benzo(a)anthracene; benzo(b)fluoranthene; benzo(k)fluoranthene; benzo(a)pyrene; benzo(g,h,i)perylene; chrysene; fluoranthene; dibenzofuran; fluorene; indeno(1,2,3-cd)pyrene; naphthalene; 2-methyl naphthalene; phenanthrene; pyrene; antimony; copper; lead; magnesium; mercury; selenium; silver; vanadium; and zinc.

A copy of Figure 7 is available at the EPA Headquarters Superfund Docket:

U.S. CERCLA Docket Office
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TABLE 11
ORGANIC AND INORGANIC SUBSTANCES DETECTED IN SURFACE SOIL SAMPLES AT THE FOLCROFT LANDFILL AND ANNEX SITE INSPECTION 1988

Sample ID	Detection Limits	SSC	FOL-5	FOL-4	FOL-3	FOL-3	FOL-1	ANN-1	ANN-2	ALS	Reference
Organic Compounds (μg/kg)											
Chlorobenzene	6	ND	ND	ND	ND	ND	ND	ND	ND	**33**	24, pp. III-11, B-2
Naphthalene	390	ND	DB	DB	DB	ND	***7,900***	ND	***1300***	ND	24, pp. III-11, B-4
2-Methyl naphthalene	390	ND	DB	DB	DB	ND	***16,000***	ND	***1400***	ND	24, pp. III-11, B-4
Acenaphthene	390	ND	DB	DB	ND	ND	DB	DB	***1200***	ND	24, pp. III-11, B-4
Fluorene	390	ND	ND	DB	ND	ND	***2,300***	DB	***1600***	ND	24, pp. III-11, B-4
Phenanthrene	390	ND	DB	***2,400***	DB	DB	***12,000***	**520**	***10,000***	DB	24, pp. III-11, B-4
Anthracene	390	ND	ND	DB	DB	ND	DB	DB	***2,200***	ND	24, pp. III-11, B-4
Fluoranthene	390	ND	DB	***5,300***	DB	DB	***3,100***	***650***	***11,000***	DB	24, pp. III-11, B-4
Pyrene	390	ND	DB	***4,000***	DB	DB	***8,300***	***590***	***5,400***	DB	24, pp. III-11, B-4
Benzo(a)anthracene	390	ND	DB	***2,100***	ND	DB	***2,800***	DB	***3,600***	DB	24, pp. III-11, B-4
Chrysene	390	ND	DB	***2,500***	ND	DB	***3,100***	DB	***4,000***	DB	24, pp. III-11, B-4
Benzo(b)fluoranthene	390	ND	DB	***2,400***	ND	DB	DB	DB	***4,700***	DB	24, pp. III-11, B-4
Benzo(k)fluoranthene	390	ND	DB	***2,300***	ND	DB	DB	DB	***2,900***	DB	24, pp. III-11, B-4
Benzo(a)pyrene	390	ND	DB	***2,300***	ND	DB	DB	DB	***3,500***	DB	24, pp. III-11, B-4
Indeno (1,2,3-cd) pyrene	390	ND	ND	DB	ND	DB	DB	DB	***740***	ND	24, pp. III-11, B-4
Benzo(g,h,i)perylene	390	ND	DB	DB	DB	DB	DB	DB	***880***	ND	24, pp. III-11, B-4
dibenzofuran	390	ND	ND	DB	ND	DB	ND	ND	***1,500***	ND	24, pp. III-11, B-4
4,4'-DDE	118	ND	ND	ND	ND	***4,200***	ND	ND	ND	ND	24, pp. III-11, B-5
4,4'-DDT	118	ND	***240***	ND	***150***	ND	ND	ND	ND	ND	24, pp. III-11, B-5
Lindane	59	ND	DB	ND	ND	***1,030***	***61.3***	ND	DB	ND	24, pp. III-11, B-5

TABLE 11 (continued)
ORGANIC AND INORGANIC SUBSTANCES DETECTED IN SURFACE SOIL SAMPLES AT THE FOLCROFT LANDFILL AND ANNEX SITE INSPECTION 1988

Sample ID	Detection Limits	SSC	FOL-5	FOL-4	FOL-3	FOL-3	FOL-1	ANN-1	ANN-2	ALS	Reference
Inorganic Compounds (mg/kg)											
Antimony	0.006	ND	***3.4***	***1.0***	***3.3***	***3.7***	***3.4***	***4.1***	***2.4***	NA	24, pp. B-2, B-6
Copper	0.010	30	***149***	***209***	***167***	***178***	84.3	***135***	36.3	NA	24, pp. B-2, B-6
Lead	0.002	62.5	***376***	***640***	***472***	***210***	***219***	132	33.0	NA	24, pp. B-2, B-6
Magnesium	0.010	1660	4630	3350	4380	3560	2700	***5,540***	4570	NA	24, pp. B-2, B-6
Mercury	0.0002	0.21	ND	0.6	***1.6***	***3.1***	***1.1***	ND	0.04	NA	24, pp. B-2, B-6
Selenium	0.003	ND	***2.9***	***2.8***	***4.0***	***3.7***	***1.7***	***2.5***	***1.7***	NA	24, pp. B-2, B-6
Silver	0.010	ND	ND	***2.5***	***12.5***	ND	***2.4***	ND	ND	NA	24, pp. B-2, B-6
Vanadium	0.010	14.3	41.0	38.8	40.2	32.3	***43.0***	***44.9***	***57.1***	NA	24, pp. B-2, B-6
Zinc	0.010	105	295	***882***	261	244	216	249	111	NA	24, pp. B-2, B-6

Notes: ***BOLD*** Concentration meets criteria for observed release, as set forth in Hazard Ranking System Table 2-3 (Ref. 1) (three times background concentration, or detection with a nondetect background), with consideration of data qualifiers (Ref. 33)
ALS Surface soil sample collected near leachate seep (Ref. 24, p. III-2)
ANN Folcroft Annex (Ref. 24, p. III-2)
DB Detected below the quantifiable limit
FOL Folcroft Landfill (Ref. 24, p. III-2)
ND None detected
SSC Control site, background (Ref. 24, p. II-2)
* These pesticides may be present as a result of routine application, therefore their presence is not attributed to waste disposed of in the landfill.

Ground Water

During the 1988 investigation, five ground water monitoring wells were installed to assess whether substances were moving from Folcroft Landfill and Annex. Three of the wells (MW-1, MW-2, and MW-3) were installed in the toe of Folcroft Landfill, along a berm area outside the primary fill area. A downgradient monitoring well (MW-5) was installed at Folcroft Annex, and an upgradient well (MW-4) was installed near an abandoned Delaware County incinerator (Ref. 24, p. III-52). Figure 8 shows the locations of the monitoring wells. The five monitoring wells installed during the investigation were designed to facilitate analysis of the ground water found in unconsolidated deposits (Ref. 24, p. III-54). The ground water found in the unconsolidated deposits at the Folcroft Landfill and Annex is unconfined and represents the water table aquifer (Ref. 24, p. III-54). The sample data are presented to identify hazardous substances found in ground water downgradient of the two landfills. The extent of source sampling at the landfills is limited. Data from analysis of ground water samples provide information about the hazardous substances in the landfills.

Ground water samples collected from the monitoring wells were analyzed for indicator metals and volatile organic compounds (VOC) (Ref. 24, p. 2, III-59). The results of analysis revealed 1,2-dichloroethene (up to 195 µg/L); chlorobenzene (up to 660 µg/L); xylene (up to 61 µg/L); acenaphthlene (up to 19 µg/L); fluorene (up to µg/L); phenanthrene (up to 29 µg/L); dibenzofuran (up to 17 µg/L); arsenic (up to 30 µg/L); barium (up to 600 µg/L); chromium (up to 60 µg/L); magnesium (up to 110,600 µg/L), manganese (up to 32,000 µg/L); nickel (up to 60 µg/L); and zinc (up to 30 µg/L) (Ref. 24, p. III-63, Table III-23; p. III-65, Table III-24; and Appendix B, Tables B-1 through B-3).

Periodic Ground Water Sampling - 1990 through 1996

From 1990 through 1996, periodic ground water sampling was conducted at the Folcroft Landfill and Annex (Refs. 25 to 30). Samples were obtained from the five monitoring wells installed in 1988.

Periodic ground water sampling at the Folcroft Landfill and Annex indicate that the landfills are sources of the following contaminants: trans-1,2-dichloroethene (up to 2.3 μg/L); vinyl chloride (up to 620 μg/L); 1,2-dichloroethene (up to 348 μg/L); 1,1-dichloroethene (up to 25 μg/L); 1,1,-dichloroethane (up to 11 μg/L); 2,2-dichloroethane (up to 16 μg/L); chloroform (up to 7.7 μg/L); benzene (up to 699 μg/L); trichloroethene (up to 120 μg/L); cis-1,2-dichloroethene (up to 510 μg/L); chlorobenzene (as high as 1200 μg/L); xylene (up to 6 μg/L); arsenic (up to 0.1 mg/L); chromium (up to 0.015 mg/L); copper (up to 0.018 mg/L); iron (up to 37 mg/L); lead (up to 0.06 mg/L); manganese (up to 6.37 mg/L); mercury (up to 0.000240 mg/L); nickel (up to 0.093 mg/L); and zinc (up to 0.04 mg/L) (Refs. 25 to 31).

A copy of Figure 8 is available at the EPA Headquarters Superfund Docket:

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Sampling Investigation - Lower Darby Creek Area - 1998

In May 1998, an investigation of the Lower Darby Creek Area was conducted to identify possible threats to human health and the environment posed by waste sources along lower Darby Creek, including the Folcroft Landfill and Annex (Ref. 31, pp. 1 and 16). During the investigation, several springs and seeps were observed on the southeastern edge of the Folcroft Landfill, along Thoroughfare Creek (a branch of Darby Creek). The edges and cover of the landfill showed erosion attributable to surface-water runoff and tidal influences, with waste materials exposed. The extent of erosion was most significant along the more steeply sloped southern side, nearest to Thoroughfare Creek and the tidal marsh. Subsurface soil borings from the landfilled area of Folcroft Landfill Annex revealed fill material (Ref. 31, p. 6).

The sampling investigation included the collection of two waste samples (one soil sample and one leachate sample) from the Folcroft Landfill (Ref. 31, pp. 21 and 23). The following substances were detected in ground water samples: barium; cobalt; iron; nickel; thallium; vinyl chloride; 1,1-dichloroethene; 1,2-dichloroethene; and chlorobenzene (Ref. 31, pp. 21, 23). The sample of solid waste revealed the presence of antimony, cadmium, lead, nickel, and silver at levels equal to or greater than three times the background concentrations (Ref. 31, Attachment 9, pp. 9-A-1 and 9-A-3). The sample identification for the waste sample was FLF/WS-43 (Ref. 31, p. 23).

Source Location (with reference to a map):

Source 7, Folcroft Landfill and Annex, is located in the 1,200-acre John Heinz NWR (formerly the Tinicum National Environmental Center) in the eastern section of Folcroft Borough, Delaware County (Ref. 31, p. 3) (Figure 1).

Containment:

Release to Ground Water: The ground water migration pathway was not evaluated.

Release via Overland Migration/Flood: As described below, there is evidence of the migration of hazardous substances from Source 7. Therefore, a surface-water containment factor value of 10 was assigned (Ref. 1, p. 51609). Refuse and industrial waste from the landfill was pushed into an adjacent swamp (Ref. 50, p. 2; Ref. 52, p. 2). An oily material from the landfill was observed to be discharged into Darby Creek (Ref. 52, p. 1). Leachate from the landfill was observed to enter Darby Creek (Ref. 54; Ref. 55; Ref. 22, p. 12; Ref. 56, pp. 1 and 2; Ref. 36, p. IV-5). Waste disposal activities moved south into a marsh adjacent to the south side of the landfill (Ref. 37, p. 22).

Gas Release to Air: The air migration pathway was not evaluated.

Particulate Release to Air: The air migration pathway was not evaluated.

2.4.1 Hazardous Substances

No waste disposal records from the landfill are available. Observations made during on-site inspections indicate that the following types of wastes were disposed of in the landfill: industrial wastes; liquid wastes; MEK; drums of liquid; sludges; petroleum liquid; barium oxide; sandblasting wastes; lead; and hospital wastes (Ref. 52, pp. 1 and 2; Ref. 53; Ref. 22, pp. 6.2-5 and 6.2-8; Ref. 45; Ref. 46, pp. 54 to 56; and Ref. 44, pp. 19 and X-4). Hazardous substances detected in drum, waste, soil, and leachate samples collected from the landfill are summarized below.

TABLE 12
HAZARDOUS SUBSTANCES DETECTED IN SAMPLES
COLLECTED FROM THE FOLCROFT LANDFILL AND ANNEX

Hazardous Substance	Evidence	Reference
Organic Compounds		
Volatile Organic Compounds		
Chlorobenzene	Leachate sample	24, p. III-11
Semi-Volatile Organic Compounds		
Anthracene	Soil sample	24, p. III-11
Acenaphthene	Drum sample Soil sample	44, Section XII; 24, p. III-11
Benzo(a)anthracene	Drum sample Soil sample	44, Section XII; 24, p. III-11
Benzo(b)fluoranthene	Drum sample Soil samples	44, Section XII; 24, p. III-11
Benzo(k)fluoranthene	Drum sample Soil samples	44, Section XII; 24, p. III-11
Benzo(a)pyrene	Drum sample Soil samples	44, Section XII; 24, p. III-11
Benzo(g,h,i)perylene	Soil sample	24, p. III-11
Chrysene	Drum sample Soil samples	44, Section XII; 24, p. III-11
Dibenzofuran	Soil sample	24, p. III-11
Fluoranthene	Drum sample Soil sample	44, Section XII; 24, p. III-11
Fluorene	Drum sample Soil sample	44, Section XII; 24, p. III-11
Indenopyrene	Drum sample	44, Section XII;
Naphthalene	Drum sample Soil sample	44, Section XII; 24, p. III-11
2-Methyl Naphthalene	Soil sample	24, p. III-11

TABLE 12 (continued)
HAZARDOUS SUBSTANCES DETECTED IN SAMPLES
COLLECTED FROM THE FOLCROFT LANDFILL AND ANNEX

Hazardous Substance	Evidence	Reference
Phenanthrene	Drum sample Soil sample	44, Section XII; 24, p. III-11
Pyrene	Drum sample Soil sample	44, Section XII; 24, p. III-11
Inorganic Compounds		
Antimony	Soil sample	24, pp. B-2, B-6; See Table 11
Arsenic	Leachate	See Table 10
Barium	Drum sample Leachate sample	44, Section XII; See Table 10
Cadmium	Waste samples	60; 61; 62; 44, Section XII; See Tables 9 and 10
Copper	Leachate sample Waste samples Soil samples	54, pp. 1 and 2; 55, pp. 1 and 2; 57 through 62; 24, pp. B-2, B-6; See Tables 9 and 111
Chromium	Leachate sample Waste samples Drum sample	54, pp. 1 and 2; 55, pp. 1 and 2; See Tables 9 and 10; 57 through 62; 44, Section XII
Iron	Leachate sample Waste samples	54, pp. 1 and 2; 55, pp. 1 and 2 57 through 62; See Table 9
Lead	Leachate Waste samples Drum samples Soil Samples	54, pp.1, 2 55, pp. 1, 2; 57 through 62; 44, Section XII; 24, pp. B-2, B-6; See Tables 9, 10, and 11
Magnesium	Soil sample	24, pp. B-2, B-6; See Table 11
Manganese	Leachate	See Table 11
Mercury	Drum samples Soil samples	44, Section XII; 24, pp B-2, B-6; See Tables 10 and 11
Nickel	Leachate sample Waste samples	54, pp. 1 and 2; 55, pp. 1 and 2; See Table 9; 57 through 62
Selenium	Soil samples	24, pp. B-2, B-6; See Table 11
Silver	Drum samples Soil samples	44, Section XII; 24, pp. B-2, B-6; See Tables 10 and 11
Zinc	Leachate sample Waste samples Soil sample	54, pp. 1 and 2; 55, pp. 1 and 2; See Tables 7, 8, 10, 12; 57 through 62; 24, pp. B-2, B-6; See Table 11
Vanadium	Leachate sample soil samples	See Table 11; 24, pp. B-2, B-6

2.4.2 Hazardous Waste Quantity

2.4.2.1.1 Hazardous Constituent Quantity

The information available is insufficient to support evaluation of the hazardous constituent quantity for Source 7.

Sum (pounds): Unknown
Hazardous Constituent Quantity Value: Not applicable (NA)

2.4.2.1.2 Hazardous Waste Stream Quantity

The information available is insufficient to support evaluation of the hazardous waste stream quantity for Source 7.

Sum (pounds): Unknown
Hazardous Waste Stream Quantity Value: NA

2.4.2.1.3 Volume

The information available is insufficient to support evaluation of the volume for Source 7.

Dimensions of the Source (yd^3): Unknown
Reference(s): NA
Volume Assigned Value: NA

2.4.2.1.4 Area

The area of the Folcroft Landfill and Annex was obtained by analysis of aerial photographs of the two landfills. The area of the two landfills is 64 acres (Ref. 37, pp. 31 and 32). The area of the landfills in ft^2 is: 64 acres × 43,560 ft^2/1 acre = 2,787,840 ft^2. The area divisor for determining the Hazardous Waste Quantity (HWQ) value assigned to a landfill is 3,400 (Ref. 1, p. 51591). The calculation of the HWQ value on the basis of the area of source is: 2,787,840/3,400 = 819.95

Area of Source (ft^2): 2,787,840
Reference(s): 48, pp. 31 and 32
Area Assigned Value: 819.95

2.4.2.1.5 Source Hazardous Waste Quantity Value

For Source 7, Folcroft Landfill and Annex, the source HWQ value is based on an area of 64 acres (Ref. 36, p. I-1). The assigned value of the source is determined from HRS Table 2-5 (Ref. 1, p. 51591).

Source Hazardous Waste Quantity Value: 819.95

TABLE 13

SUMMARY OF SITE SOURCE DESCRIPTIONS

Source Number	Source Name	Source HWQ Value	Containment			
			Ground Water	Surface Water	Air Gas	Air Particulate
1	Clearview Landfill	832.77	NS	10	NS	NS
2	Industrial Drive Properties	>0	NS	10	NS	NS
3	Oil Sludge Disposal Area	83.97	NS	10	NS	NS
4	Catalyst Disposal Area	7.61	NS	10	NS	NS
5	Sewage Sludge Disposal Area	4.48	NS	10	NS	NS
6	Delaware County Incinerator Landfill	192.18	NS	10	NS	NS
7	Folcroft Landfill and Annex	819.95	NS	10	NS	NS

NS Not Scored

HWQ Total = 1,940.96

4.0 Surface Water Migration Pathway

4.1 Overland/Flood Migration Component

4.1.1.1 Definition of Hazardous Substance Migration Pathway for Overland Flow/Flood Component

Surface waters associated with the surface-water migration pathway for the Lower Darby Creek Area include Cobbs Creek, Darby Creek, Hermesprota Creek, Muckinipattis Creek, and Thoroughfare Creek, a branch of Darby Creek that flows along the eastern boundary of Folcroft Landfill. Thoroughfare Creek is sometimes referred to as Darby Creek. The surface water adjacent to the southern boundary of the Folcroft Landfill is referred to as both the Tidal Marsh and Darby Creek (Ref. 36, Figure following p. III-1). The farthest upstream segment of the surface-water pathway is located at the northern end of Clearview Landfill, where Cobbs Creek merges with Darby Creek. Darby Creek then flows south through the Lower Darby Creek Area. As it flows generally from north to south through the study area, Darby Creek flows by the following sources in order from north to south: the Clearview Landfill, the Industrial Drive Properties, the Oily Sludge Disposal Area, the Catalyst Disposal Area, the Sewage Sludge Disposal Area, the former Delaware County Incinerator Landfill, and the Folcroft Landfill and Annex (Ref. 34). Surface water runoff from all these sources drain to Darby Creek and the John Heinz NWR (Figure 9). An enclosed area called the impoundment lies adjacent to the east side of Darby Creek in the area of Folcroft Landfill (Ref. 49). There are connections between Darby Creek and the impoundment (Ref. 36, p. III-3). Hermesprota Creek enters the study area from the north and flows along the western border of the former Delaware County Incinerator Landfill before channeling between the Folcroft Landfill and Annex; Hermesprota Creek ultimately discharges to Darby Creek in the John Heinz NWR (Ref. 34). Muckinipattis Creek flows south into Darby Creek, downstream of both the Folcroft Landfill and Annex and Hermesprota Creek at a point in the John Heinz NWR. After receiving discharge from the tributaries described above, Darby Creek empties into the Delaware River (Ref. 34; Ref. 5, p. 4; Ref. 20, p. 3-1) (Figure 9).

Darby Creek is tidally influenced upstream to the confluence of Darby Creek and Cobbs Creek (Ref. 24, p. II-5). Numerous private and public agencies have been contacted to determine more exactly the extent of tidal influence of Darby Creek; however, no data are available that document the extent of tidal influence in the creek. Therefore, the upstream target distance limit (TDL) was not evaluated. Additionally, no significant targets have been identified upstream of Clearview Landfill or from the confluence of Cobbs Creek and Darby Creek (the farthest upstream point of the TDL). Areas upstream of Clearview Landfill are urbanized and developed and are not expected to provide significant habitat for threatened or endangered species identified under federal or state statute or other environmental targets (Ref. 34). No significant wetlands have been identified upstream of Clearview Landfill (Ref. 84).

A copy of Figure 9 is available at the EPA Headquarters Superfund Docket:

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The surface-water migration pathways for each source are described below.

Source 1 - Overland Flow and PPE 1

Surface water runoff from Source 1, the Clearview Landfill, is expected to enter Cobbs Creek or Darby Creek at any of the landfill boundaries along Darby Creek. No surface-water containment structures are located on the landfill (Ref. 36, p. IV-9). Tributaries of Cobbs Creek and Darby Creek formerly located on the landfill, were filled from the Landfill operation (Ref. 4). Figure 10 shows the probable point of entry (PPE) for Source 1. The 15-mile downstream TDL from Source 1 is described below and can be measured on Reference 34.

TABLE SW-1
SOURCE 1 - TARGET DISTANCE LIMIT

Segment	Description	Length (feet)	Mile/Feet Marker
1	From the PPE for Cobbs Creek to the confluence with Darby Creek	1,000	0.2/1,000
2	From Darby Creek to the Delaware River	23,760	4.7/24,760
3	Remainder of the TDL in the Delaware River	54,440	15/79,200

Source 2 - Overland Flow and PPE 2

Surface-water runoff from Source 2, the Industrial Drive Properties, is expected to follow the contours of the topography and enter Darby Creek anywhere along its eastern boundary (Ref. 34; Ref. 4). The farthest downstream PPE for Source 2 was selected as the PPE and is shown in Figure 11. The 15-mile TDL from Source 2 is described below and was measured on Reference 34.

TABLE SW-2
SOURCE 2 - TARGET DISTANCE LIMIT

Segment	Description	Length (feet)	Mile/Feet Marker
1	From the PPE for Darby Creek to the Delaware River	25,288	4.7/25,288
2	Remainder of the TDL in the Delaware River	54,384	15/79,200

A copy of Figure 10 is available at the EPA Headquarters Superfund Docket:

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Source 3 - Overland Flow and PPE 3

The Oil Sludge Disposal Area (Source 3) is located on the Darby Creek Tank Farm. Run-off from the Darby Creek Tank Farm accumulates within the bermed areas of the tank farm, where it migrates to groundwater or evaporates, or flows on the surface in a southeastward direction, accumulating in two storm runoff ponds. The water in the ponds is used for firefighting. Any overflow from the ponds is discharged into Darby Creek. Surface-water runoff from the Oily Sludge Disposal Area can also follow the contours of land and flow east into Darby Creek at PPE 3, which is located within 75 feet of the source (Ref. 75, p. 22; Ref. 74, p. 2-5; Ref. 34) (Figure 12). The 15-mile TDL from Source 3 is described below and can be measured on Reference 34.

TABLE SW-3
SOURCE 3 - TARGET DISTANCE LIMIT

Segment	Description	Length (feet)	Mile/Feet Marker
1	From the PPE for Darby Creek to the Delaware River	24,288	4.6/24,288
2	Remainder of TDL in the Delaware River	54,912	15/79,200

Source 4 - Overland Flow and PPE 4

The Catalyst Disposal Area (Source 4) is located on the Darby Creek Tank Farm. Run-off from the Darby Creek Tank Farm accumulates within the bermed areas of the tank farm, where it migrates to groundwater or evaporates, or flows on the surface in a southeastward direction, accumulating in two storm runoff ponds. The water in the ponds is used for firefighting. Any overflow from the ponds is discharged into Darby Creek. Surface water runoff from Source 4, the Catalyst Disposal Area, is expected to flow southeast into Darby Creek through stormwater runoff; PPE 4 is located along Darby Creek, approximately 1,600 feet from the source (Ref. 74, p. 3-2; p. 22; Ref. 74, p. 2-5; Ref. 34) (Figure 12). The 15-mile TDL from Source 4 is described below and can be measured on Reference 34.

TABLE SW-4
SOURCE 4 - TARGET DISTANCE LIMIT

Segment	Description	Length (feet)	Mile/Feet Marker
1	From the PPE for Darby Creek to the Delaware River	23,760	4.5/23,760
2	Remainder of the TDL in the Delaware River	55,440	15/79,200

A copy of Figure 12 is available at the EPA Headquarters Superfund Docket:

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Source 5 - Overland Flow and PPE 5

Historical aerial photographs indicate that disposal activity at Source 5, the Sewage Sludge Disposal Area, began in approximately 1958 and involved the dumping of material directly into a wetland area along Darby Creek (Ref. 37, pp. 24-25). Therefore, the distance from the source to the PPE for Darby Creek, located at the downstream end of this source, is zero (Ref. 1, p. 51611). Figure 13 shows the PPE for Source 5. The 15-mile TDL for Source 5 is described below and can be measured on Reference 34.

TABLE SW-5
SOURCE 5 - TARGET DISTANCE LIMIT

Segment	Description	Length (feet)	Mile/Feet Marker
1	From the PPE for Darby Creek to the Delaware River	21,120	4.0/21,120
2	Remainder of the TDL in Delaware River	58,080	15/79,200

Source 6 - Overland Flow and PPE 6

Historical information indicates that Hermesprota Creek has eroded the western edge of Source 6, the former Delaware County Incinerator Landfill (Ref. 32, pp. 3-4). Therefore, the distance from the source to the PPE, located along Hermesprota Creek at the downstream end of the source, is zero (Ref. 1, p. 51611). Figure 14 shows the PPE for Source 6. The 15-mile TDL from Source 6 is described below and can be measured on Reference 34.

TABLE SW-6
SOURCE 6 - TARGET DISTANCE LIMIT

Segment	Description	Length (feet)	Mile/Feet Marker
1	From the PPE for Hermesprota Creek to its confluence with Darby Creek	5,000	0.95/5,000
2	From Darby Creek to the Delaware River	15,840	3.95/20,840
3	Remainder of the TDL in Delaware River	58,360	15/79,200

A copy of Figure 13 is available at the EPA Headquarters Superfund Docket:

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A copy of Figure 14 is available at the EPA Headquarters Superfund Docket:

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Source 7 - Overland Flow and PPE - 7

During operation of Source 7, the Folcroft Landfill and Annex, refuse and industrial waste from the landfill were pushed into an adjacent swamp (Ref. 50, p.2; Ref. 52, p. 2). In addition, an oily material was observed to discharge into Darby Creek (Ref. 52, p. 1). Leachate from the landfill also has been observed to enter Darby Creek (Ref. 54; Ref. 55; Ref. 22, p. 12; Ref. 56, pp. 1-2; Ref. 36, p. IV-5). Overland flow follows the topographic contours, and runoff enters Darby Creek, Hermesprota Creek, and the adjacent tidal marsh. Therefore, two PPEs are identified for this source: one located at the north end of the Folcroft Landfill Annex along Hermesprota Creek (PPE 7-N), and one located on the east side of the Folcroft Landfill along Darby Creek (PPE 7-E) (Ref. 36, p. III-3; Ref. 34). Figure 15 shows the PPE for Source 7. The 15-mile TDL from Source 7 is described below and can be measured on Reference 34. In light of the past observations of disposal activities, the distance from the source to the PPEs is zero.

TABLE SW-7
SOURCE 7 - TARGET DISTANCE LIMIT

Segment	Description	Length (feet)	Mile/Feet Marker
PPE 7-N			
1	From the PPE for Hermesprota Creek to the confluence with Darby Creek	5,280	1.0/5,280
2	From Darby Creek to the Delaware River	15,840	4.0/21,120
3	Remainder of the TDL in the Delaware River	58,080	15/79,200
PPE 7-E			
1	From the PPE for Darby Creek to the Delaware River	21,120	4.0/21,120
2	Remainder of the TDL in the Delaware River	58,080	15/79,200

A copy of Figure 15 is available at the EPA Headquarters Superfund Docket:

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4.1.2.1 LIKELIHOOD OF RELEASE

The surface-water migration pathway is evaluated against the criteria for an observed release of hazardous substances, supported by direct observation and chemical analysis.

4.1.2.1.1 Observed Release

Observed releases to Darby Creek and Hermesprota Creek have been documented by direct observation and chemical analysis. A discussion of the documentation that supports observed releases to each of surface-water bodies is provided in the section below.

Direct Observation

Observed releases by direct observation to Darby Creek from the Clearview Landfill and the Folcroft Landfill and Annex have been documented. Wastes disposed of in the Clearview Landfill and the Folcroft Landfill and Annex were deposited directly into wetlands and surface water. Leachate from the landfills was observed to flow directly to Darby Creek. The sections below document observed releases by direct observation from the Clearview Landfill and the Folcroft Landfill and Annex.

Direct Observation - Clearview Landfill

The 1953 aerial photographs of the current location of the Clearview Landfill show the area to consist of wetlands with tributaries of Cobbs Creek and Darby Creek flowing through the landfill (Ref. 4, p. 6). The 1958 aerial photograph shows the ongoing filling of wetland areas (Ref. 4, pp. 8 and 9). The 1973 aerial photograph indicates that all the wetlands and tributaries had been filled by the landfill (Ref. 4, pp. 16 and 17). Aerial photographs document that wastes disposed of in the landfill were deposited directly into wetlands, Darby Creek, and Cobbs Creek (Ref. 4, pp. 16 and 17a).

In 1982, an aqueous sample was collected from leachate that was observed to enter Darby Creek (Ref. 9, pp. 5 and 16). The leachate contained the following hazardous substances: aluminum (2,210 microgram per liter [μg/L]), cadmium (2.05 μg/L), chromium (30 μg/L), copper (120 μg/L), iron (12,290 μg/L), manganese (490 μg/L), nickel (30μg/L), lead (407.5 μg/L), and zinc (320 μg/L) (Ref. 9, p. 16).

Direct Observation - Folcroft Landfill and Annex

During a PADER inspection of the landfill in 1969, refuse was observed to have been pushed into a swamp along the west side of the landfill (Ref. 50, p. 2). During a 1970 inspection, an oily material was observed to be discharged into an inlet of Darby Creek (Ref. 52, p. 1). Refuse on the east side of the landfill was being pushed into the water. Industrial waste consisting of oil-soaked Fuller's earth and material of various colors of green, lavender, white, and red was placed directly in the marsh on the southeast corner of the landfill (Ref. 52, p. 2). In response to the inspection, a NOV was issued to Folcroft Land Corporation (the owners of Folcroft Landfill and Annex) for placing industrial waste and refuse into waters of the Commonwealth without a valid permit (Ref. 51).

In October 1972, samples of leachate discharging into a marsh on the southern and western sides of the landfill were collected (Ref. 54 and 55). Because the leachate was observed to discharge on the southern and western sides of the landfill, the leachate would have been discharging into Hermesprota Creek and Darby Creek (see Figure 1). The table below summarizes the results of the chemical analysis of the leachate sample.

TABLE SW-8
1972 SUMMARY OF FOLCROFT LANDFILL LEACHATE ANALYTICAL RESULTS

Sample Locations Sample Number	Southwestern Side Landfill 682268	West Side Landfill 682267	Reference
Inorganic Substances (μg/L)			
Copper	30	150	54, pp. 1 and 2 55, pp. 1 and 2
Chromium	20	20	54, pp. 1 and 2 55, pp. 1 and 2
Iron	48,800	16,500	54, pp. 1 and 2 55, pp. 1 and 2
Nickel	90	0	54, pp. 1 and 2 55, pp. 1 and 2
Zinc	31	120	54, pp. 1 and 2 55, pp. 1 and 2
Lead	330	160	54, pp. 1 and 2 55, pp. 1 and 2

Based on the analytical results obtained from the leachate, copper, chromium, iron, nickel, zinc, and lead were discharged directly into Hermesprota Creek and Darby Creek.

In December 1972, a leachate sample was collected from a leachate seep discharging into Tinicum Marsh (Darby Creek). The following inorganic contaminants were detected in the sample: copper (50 μg/L), chromium (40 μg/L), iron (37,500 μg/L), nickel (40 μg/L), zinc (440 μg/L), and cadmium (60 μg/L) (Ref. 56, pp. 1 and 2).

Leachate was observed to enter surface water from the Folcroft Landfill during numerous investigations (Ref. 22, pp. 12 and 2-2; Ref. 36, p. IV-5). During a 1986 investigation, numerous leachate seeps were observed flowing from the annex directly into the adjacent tidal flat. Seeps from the Folcroft Landfill were observed along the boundaries of the landfill adjacent to Hermesprota Creek and Thoroughfare Creek (Ref. 36, p. IV-5). Samples of those leachate seeps were not collected.

During a 1998 investigation a sample of leachate flowing into Darby Creek was collected (Ref. 31, p. 23). Analysis of the sample revealed the presence of arsenic, barium, chromium, iron, manganese, nickel, and zinc (Ref. 31, p. 23; Ref. 83, Appendix D, p. 2, Appendix B, p. 1, and Appendix C, SDG MCSC48, p. 11).

Chemical Analysis

In 1998 surface water samples were collected from the Lower Darby Creek Area site to determine whether sources within the site were impacting John Heinz NWR and surface water bodies within the Darby Creek watershed (Ref. 31, p. 1). Sediment samples were collected from the Darby Creek watershed upstream of the sources (background locations) to downstream of the sources (Ref. 31, pp. 18 to 25 and Figure 7). The analytical data from the 1998 sampling event supporting an observed release by chemical analysis to the Darby Creek watershed are presented below.

1998 Background Samples

Background samples of surface water and sediment were collected from Darby Creek, Cobbs Creek, and Hermesprota Creek during May 1998. The following background samples were collected for Darby Creek: sample from two locations in Darby Creek (DAR/SW02, DAR/SD02, and DAR/SW03, DAR/SD03), and samples from one location in Cobbs Creek (COB/SW04). One background sample was collected from Hermesprota Creek (HER/SW31, HER/SD31) (Ref. 31, pp. 19 and 21) (Figure 16). The background samples were collected upsteam from all the sources location within the Lower Darby Creek Area site. Table 19 summarizes the locations from which the background samples were collected and the dates on which they were collected.

A copy of Figure 16 is available at the EPA Headquarters Superfund Docket:

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TABLE SW-9
BACKGROUND SAMPLE LOCATIONS
1998 SITE INSPECTION

Sample ID	Sample Location/Objective	Date	Reference
DAR/SW02 DAR/SD02	Darby Creek upstream of the Clearview Landfill; background comparison for Darby Creek samples	May 21, 1998	31, pp. 17, 19 Table SW-11
DAR/SW03 DAR/SD03	Darby Creek upstream of the Clearview Landfill; background comparison for Darby Creek samples	May 21, 1998	31, pp. 17, 19 Table SW-11
COB/SW04 COB/SD04	Cobbs Creek upstream of the Clearview Landfill; background comparison for Darby Creek samples	May 20, 1998	31, pp. 17, 19 Table SW-11
HER/SW31 HER/SD31	Hermesprota Creek upstream of the former Delaware County Incinerator Landfill and the Folcroft Landfill and Annex; background comparison for Hermesprota Creek samples	May 19, 1998	31, pp. 17, 21 Table SW-15

1998 Contaminated Samples

The results of analyses of samples of surface water and sediment collected from Darby Creek and Hermesprota Creek document an observed release to surface water. The table below summarizes the identifications of the samples, the locations from which the contaminated samples were collected and the dates they were collected.

TABLE SW-10
SUMMARY OF THE LOCATIONS OF THE CONTAMINATED SAMPLES
1998

Sample ID	Sample Location/Objective	Date	Reference
Hermesprota Creek			
DCI/SW35 DCI/SD35	Hermesprota Creek near southwest corner of former Delaware County Incinerator Landfill, downstream of the former Incinerator Landfill and Folcroft Landfill and Annex	May 19, 1998	31, p. 22 and Figure 7; Ref. 83, Appendix D, p. 3
HER/SW39 HER/SD39	Hermesprota Creek adjacent to the east side of the Folcroft Landfill Annex, downstream of the former Incinerator Landfill and Folcroft Landfill and Annex	May 19, 1998	31, p. 23 and Figure 7; Ref. 83, Appendix D, p. 2
Darby Creek			
DAR/SW13 DAR/SD13	Darby Creek on the west side and downstream of the Clearview Landfill	May 20, 1998	31, p. 20 and Figure 7; Ref. 83, Appendix D, p. 6
DAR/SW38 DAR/SD38	Darby Creek downstream of Clearview Landfill, Industrial Drive Properties, the Catalyst Disposal Area, the Oily Sludge Disposal Area, the former Delaware County Incinerator Landfill, and the Sewage Sludge Disposal Area	May 21, 1998	31, p. 17, 22; Figure 7; Ref. 83, Appendix D, p.13
DAR/SW46 DAR/SD46	Darby Creek (tidal marsh) adjacent to the Folcroft Landfill, downstream of Clearview Landfill, Industrial Drive Properties, the Catalyst Disposal Area, the Oily Sludge Disposal Area, the former Delaware County Incinerator Landfill, the Sewage Sludge Disposal Area, and the Folcroft Landfill and Annex	May 21, 1998	31, p. 24 and Figure 7; Ref. 83, Appendix D, p. 11
DAR/SW47 DAR/SD47	Darby Creek downstream of Clearview Landfill, Industrial Drive Properties, the Catalyst Disposal Area, the Oily Sludge Disposal Area, the former Delaware County Incinerator Landfill, the Sewage Sludge Disposal Area, and the Folcroft Landfill and Annex	May 21, 1998	31, p. 23 and Figure 7; Ref. 83, Appendix D, p. 10
DAR/SW49 DAR/SD49	Darby Creek between Hermesprota and Muckinipattis Creeks, downstream of Clearview Landfill, Industrial Drive Properties, the Catalyst Disposal Area, the Oily Sludge Disposal Area, the former Delaware County Incinerator Landfill, the Sewage Sludge Disposal Area, and the Folcroft Landfill and Annex	May 20, 1998	31, p. 24 and Figure 7; Ref. 83, Appendix D, p. 7
DAR/SW50 DAR/SD50	Darby Creek between Hermesprota and Muckinipattis Creeks, downstream of Clearview Landfill, Industrial Drive Properties, the Catalyst Disposal Area, the Oily Sludge Disposal Area, the former Delaware County Incinerator Landfill, the Sewage Sludge Disposal Area, and the Folcroft Landfill and Annex	May 20, 1998	31, p. 24 and Figure 7; Ref. 83, Appendix D, pp. 10, 11

TABLE SW-10
SUMMARY OF THE LOCATIONS OF THE CONTAMINATED SAMPLES
1998

Sample ID	Sample Location/Objective	Date	Reference
Darby Creek			
DAR/SW52 DAR/SD52	Darby Creek downstream of Muckinipattis Creek, downstream of Clearview Landfill, Industrial Drive Properties, the Catalyst Disposal Area, the Oily Sludge Disposal Area, the former Delaware County Incinerator Landfill, the Sewage Sludge Disposal Area, and the Folcroft Landfill and Annex	May 20, 1998	31, p. 24-25 and Figure 7; Ref. 83, Appendix D, p. 10
DAR/SW54 DAR/SD54	Darby Creek downstream of Pennsylvania Route 420 and Clearview Landfill, Industrial Drive Properties, the Catalyst Disposal Area, the Oily Sludge Disposal Area, the former Delaware County Incinerator Landfill, the Sewage Sludge Disposal Area, and the Folcroft Landfill and Annex	May 20, 1998	31, p. 25 and Figure 7; Ref. 83, Appendix D, p. 14

Observed Release to Darby Creek

Table SW-11 summarizes the concentrations of inorganic compounds detected in the background aqueous samples collected from Darby and Cobbs Creeks. The highest concentration from the three background samples is used for background.

Table SW-12 summarizes the concentrations of inorganic compounds detected in the release aqueous samples collected from Darby Creek. Concentrations of hazardous substances that appear in the table in bold and italic type meet the analytical criteria for documentation of an observed release to surface water by chemical analysis (Ref. 1, pp. 51589 and 51609).

Table SW-13 summarizes the concentrations of inorganic compounds and Aroclor 1242 detected in the background sediment samples collected from Darby Creek. The highest concentration from the three background samples are used for background.

Table SW-14 summarizes the concentration of inorganic compounds detected in the release sediment samples collected from Darby Creek. Concentrations of hazardous substances that appear in the table in bold and italic type meet the criteria for documentation of an observed release to surface water by chemical analysis (Ref. 1, pp. 51589 and 51609).

Table SW-15 summarizes the concentrations of hazardous substances detected in background and release surface-water samples collected from Hermesprota Creek. Concentrations of hazardous substances that appear in the table in bold and italic type meet the analytical criteria for documentation of an observed release to surface water by chemical analysis (Ref. 1, pp. 51589 and 51609).

Table SW-16 summarizes the concentrations of hazardous substances detected in background and release sediment samples collected from Hermesprota Creek. Concentrations of hazardous substances that appear in the table in bold and italic type meet the analytical criteria for documentation of an observed release to surface water by chemical analysis (Ref. 1, pp. 51589 and 51609).

TABLE SW-11
CONCENTRATIONS OF HAZARDOUS SUBSTANCES DETECTED IN
DARBY CREEK SURFACE WATER - BACKGROUND SAMPLES
1998 SITE INSPECTION

Sample No.			DAR/SW02		DAR/SW03		COB/SW04	
Laboratory ID			MCSD17		MCSD25		MCSD27	
Sample Date			5/21/98		5/21/98		5/20/98	
Reference			31, p. 21; Ref. 83, Appendix D, p. 11, Appendix B, p. 6, and Appendix C, SDG MCS00, p. 10		31, p. 22; Ref. 83, Appendix D, p. 12, Appendix B, p. 6, and Appendix C, SDG MCD00, p. 11		31, p. 22; Ref. 83, Appendix D, p. 12, Appendix B, p. 7, and Appendix C, SDG MCSD00, p. 12	
Sample Location	CRDL	Highest Background Concentration*	Darby Creek Background	Q	Darby Creek Background	Q	Cobbs Creek Background	Q
Inorganic Compounds (µg/L)								
Aluminum	200	586	162	B	547	J	586	J
Arsenic	5	U		U		U		U
Cadmium	5	3.4	2		0.34	B	3.4	
Chromium	10	3.7	1.6		3.7		2.6	
Cobalt	40	1.4		U	1.4	B		U
Iron	100	1480	292	B	1480		1400	
Manganese	15	161	38.2		98.5		161	
Mercury	0.2	UL		UL		UL		UL
Nickel	40	4.5		U	4.3		4.5	
Selenium	3	3.0L		UL	3.0	L		UL
Vanadium	50	4.1B	1.9	B	4.1	B	4	B
Zinc	20	43.1B	36.7	B	42.7	B	43.1	B

Notes:
* The highest concentration detected in one of the three background samples is used as the background concentration.
B Not detected substantially above the level reported in the laboratory or field blanks.
CRDL Contract Required Detection Limit.
J Analyte present; reported value may not be accurate or precise.
L Analyte present, but reported value may be biased low.
Q Data qualifier
UL Not detected; quantitation limit is probably higher.
µg/L Micrograms per liter
Empty cell indicates that the compound was not detected.

TABLE SW-12
CONCENTRATIONS OF HAZARDOUS SUBSTANCES DETECTED IN
DARBY CREEK SURFACE WATER OBSERVED RELEASE SAMPLES
1998 SITE INSPECTION

Sample No.			DAR/SW19		DAR/SW38		DAR/SW49		DAR/SW50		DAR/SW52		DAR/SW54	
Laboratory ID			MCSD00		MCSD37		MCSD89		MCSD13		MCSD09		MCSD38	
Sample Date			5/21/98		5/21/98		5/20/98		5/20/98		5/20/98		5/20/99	
Reference			31, p. 20; Ref. 83, Appendix D, p. 9, Appendix B, p. 6, and Appendix C, SDG MCSD00, p. 2		31, p. 22; Ref. 83, Appendix D, p. 3, Appendix B, p. 12, and Appendix C, SDG MSCD37, p. 2		31, p. 24, Ref. 83, Appendix D, p. 7, Appendix B, p. 5, and Appendix C, SDG MCSC48, p. 4		31, p. 24; Ref. 83, Appendix D, p. 11, Appendix B, p. 6, and Appendix C, SDG MSCD00, p. 8		31, p. 25; Ref. 83, Appendix D, p. 10, Appendix B, p. 6, and Appendix C, SDG MCSD00, p. 6		31, p. 25, Ref. 83, Appendix D, p. 14, Appendix B, p. 12, and Appendix C, SDG MSCD37, p. 3	
Sample Location	CRDL	Highest Background Concentration*	Darby Creek	Q	Darby Creek	Q	Darby Creek	Q	Darby Creek	Q	Darby Creek	Q	Darby Creek	Q
Inorganic Compounds (µg/L)														
Aluminum	200	586			377		650		***8110***	J	***3300***	J	174	B
Arsenic	15	U	***3.5***	K		UL			***4.4***	K	***7.2***	K	***4.4***	L
Cadmium	5	3.4			***88.9***		7.1	L	2.1	B	1.3	B	**15.7**	J
Chromium	10	3.7			2		3.5	L	***30***		***14.2***			
Cobalt	40	1.4					1.6	L	***10.7***		4.7	B		
Iron	100	1480			871		1650		***14800***		***7000***		430	B
Manganese	15	161			80		203	J	***832***		419		47.5	
Mercury	0.2	UL				UL		UL	***0.21***	L				UL
Nickel	40	4.5			2.1		5.4	L	***18.7***		11.4			
Vanadium	50	4.1			2		4.2	L	***23.1***		***12.6***		1.3	
Zinc	20	43.1			22.1	B	93.1	B	***262***	J	163	J	17	B

Notes:
* The highest concentration detected in one of the three background samples is used as the background concentration (see Table SW-11).
BOLD Concentration meets criteria for observed release as set forth in HRS Table 2-3 (Ref. 1) (three times background concentration, or detection with a nondetect background), with consideration of data qualifiers (Ref. 33).
B Not detected substantially above the level reported in the laboratory or field blank.
CRDL Contract Required Detection Limit
J Analyte present; reported value may not be accurate or precise.
Q Data qualifier
UL Not detected; quantitation limit is probably higher.
µg/L Micrograms per liter.
Empty cell indicates that the compound was not detected.

TABLE SW-13
CONCENTRATIONS OF HAZARDOUS SUBSTANCES DETECTED IN
DARBY CREEK BACKGROUND SEDIMENT SAMPLES
1998 SITE INSPECTION

Sample Number			DAR/SD-02	DAR/SD-03	COB/SD-04
Laboratory ID			MCSD16	MCSD24	MCSD26
Sample Date			5/21/98	5/21/98	5/21/98
Reference			31, p. 19 and Fig. 7; Ref. 83, Appendix D, p. 11, Appendix B, p. 8, and Appendix C, SDG MCSD01, p. 10; Ref. 85, Appendix B, p. 45	31, p. 19 and Fig. 7, Ref. 83, Appendix D, p. 12, Appendix B, p. 9, and Appendix C, SDG MCSD01, p. 17; Ref. 85, Appendix B, p. 45	31, p. 19 and Fig. 7, Ref. 83, Appendix D, p. 12, Appendix B, p. 9, and Appendix C, SDG MCSD01, p. 5; Ref. 85, Appendix B, p. 45
Sample Location	CRDL	Highest Background Concentration*	Background Darby Creek	Background Darby Creek	Background
Inorganic Compounds (mg/kg)					
Antimony	12	ND	ND	ND	ND
Cadmium	1	1.1	1.1	0.78 B	ND
Manganese	3	725	451	725	262
Silver	2	1.1	0.3	1.1	ND
PCBs (µg/kg)					
Aroclor 1242	33	ND	ND	ND	ND

Notes:
* The highest concentration detected in one of the three background samples is used as the background concentration.
B Not detected substantially above the level reported in Laboratory or field blank.
CRDL Contract Required Detection Limit.
J Analyte present; reported value may not be accurate or precise.
Q Data qualifier
UL Not detected; quantitation limit is probably higher.
µg/L Micrograms per liter

TABLE SW-14
CONCENTRATIONS OF HAZARDOUS SUBSTANCES DETECTED IN
DARBY CREEK RELEASE SEDIMENT SAMPLES
1998 SITE INSPECTION

Sample Number			DAR-SD46	DAR-SD47	DAR-SD52
Laboratory ID			MCSD14	MCSD06	MCSD08
Sample Date			5/21/98	5/21/98	5/20/98
Reference		Highest Background Concentration*	31, p. 23; Ref. 83, Appendix D, p. 11, Appendix B, p. 8, and Appendix C, SDGMCSD01, p. 9; Ref. 85, Appendix B, p. 43	31, p. 24; Ref. 83, Appendix D, p. 10, Appendix B, p. 8, and Appendix C, SDG MCSD01, p. 5; Ref. 85, Appendix B, p. 43	31, p. 25; Ref. 83, Appendix D, p. 10, Appendix B, p. 8, and Appendix C, SDG MCSD01, p. 6; Ref. 85, Appendix B, p. 44
Sample Location	CRDL		Tidal Marsh Darby Creek	Darby Creek	Darby Creek
Inorganic Compounds (mg/kg)					
Antimony	12	ND	3.2 L	ND	ND
Cadmium	1	1.1	***4.0***	***3.9***	***3.7***
Manganese	3	725	141	***2550***	299
Silver	2	1.1	***3.4***	2.5	2.3
PCBs (µg/kg)					
Aroclor 1242	33	ND	***360J***	ND	ND

Notes:
* The highest concentration detected in one of the three background samples is used as the background concentration (see Table SW-13).
BOLD Concentration meets criteria for observed release as given in HRS Table 2-3 (Ref. 1) (three times background concentrations or detection with non-detect background), with consideration of data qualifiers (Ref. 33).
B Not detected substantially above the level reported in Laboratory or field blank.
CRDL Contract Required Detection Limit
J Analyte present; reported value may not be accurate or precise.
Q Data qualifier
UL Not detected; quantitation limit is probably higher.
mg/kg Milligram per kilogram
µg/kg Microgram per kilogram

TABLE SW-15
CONCENTRATIONS OF HAZARDOUS SUBSTANCES DETECTED IN
HERMESPROTA CREEK BACKGROUND AND RELEASE SURFACE WATER SAMPLES
1998 SITE INSPECTION

Sample No.		HER/SW31		DAR/SW35		DAR/SW39	
Laboratory ID		MCSC79		MCSC64		MCSC55	
Sample Date		5/19/98		5/19/98		5/19/98	
Reference		31, p. 19, Ref. 83, Appendix D, p. 6, Appendix B, p. 5, and Appendix C, SDG MCSC74, p. 5		31, p. 22; Ref. 83, Appendix D, p. 3, Appendix B, p. 2, and Appendix C, SDC MSCDC48, p. 14		31, p. 22, Ref. 83, Appendix D, p. 2, Appendix B, p. 1, and Appendix C, SDG MCSC48, p. 10	
Sample Location	CRDL	Background Hermesprota Creek		Hermesprota Creek		Hermesprota Creek	
Inorganic Compounds (ug/L)							
Aluminum	200			***9,150***		***333,000***	
Arsenic	5	3.5		5.3	L	***172***	
Barium	100	83.8		***357***		***5,030***	
Cadmium	5			5.1		***55***	
Chromium	10			***42.4***		***1,520***	
Cobalt	40			6.6		***264***	
Copper	20	3.5	B	***120***		***2,070***	
Iron	100			***17,500***		***987,000***	
Lead	2			***385***	J	***3,890***	
Magnesium	500	14,400		43,600		***147,000***	
Manganese	15	24.4	B	***858***		***13,700***	
Mercury	0.2			***0.45***	J		UL
Nickel	40			***47.1***		***784***	
Silver	10					***37.3***	
Thallium	3		UL	***5.7***	L	***42.8***	
Vanadium	50			27.7		***1,020***	
Zinc	20	11.5	B	***792***		***9,200***	

Notes:

BOLD Concentration meets criteria for observed release as given in HRS Table 2-3 (Ref. 1) (three times background concentrations or detection with non-detect background), with consideration of data qualifiers (Ref. 33).

B Not detected substantially above the level reported in Laboratory or field blank.

J Analyte present; reported value may not be accurate or precise.

UL Not detected; quantitation limit is probably higher.

TABLE SW-16
CONCENTRATIONS OF HAZARDOUS SUBSTANCES DETECTED IN
HERMESPROTA CREEK BACKGROUND CONCENTRATIONS AND RELEASE SEDIMENT SAMPLES
1998 SITE INSPECTION

Sample Number		HER/SD-31 (BK)		DCI/SD-35		HER/SD-39	
Laboratory ID		MSCS78		MSCS63		MSCS56	
Sample Date		5/19/98		5/19/99		5/19/99	
Reference		31, p. 21; Ref. 83, Appendix D, p. 5, Appendix B, p. 10, and Appendix C, SDG MCSD28, p. 2; Ref. 85, Appendix B, p. 21		31, p. 22, Ref. 83, Appendix D, p. 3, Appendix B, p. 3, and Appendix C, SDG MCSC56, p. 6; Ref. 85, Appendix B, p. 22		31, p. 23; Ref. 83, Appendix D, p. 2, Appendix B, p. 3, and Appendix C, SDG MCSC56, p. 2; Ref. 83, Appendix B, p. 22	
Sample Location	CRDL	Hermesprota Creek Upstream of All Sources	Data Qualifier	Hermesprota Creek Near Incinerator Ash Disposal Area	Data Qualifier	Hermesprota Creek Adjacent to Folcroft Landfill	Data Qualifier
Inorganic Compounds (mg/kg)							
Antimony	12	ND		***19.5***	L	ND	
Barium	40	78.4		***662***		210	
Beryllium	1	0.35		0.83		***1.1***	
Cadmium	1	0.92	B	***15.5***		***3.2***	
Chromium	2	25.8		***134***		***94.5***	
Cobalt	10	6.2		***20***		16.6	
Copper	5	41.1		***466***	J	96.7	J
Iron	20	21800		***88400***		37900	
Lead	0.6	167	J	***1620***		199	
Nickel	8	11.8		***130***		***48.4***	
Silver	2	0.68		***7.9***		***4.1***	
Zinc	4	215		***2650***		540	
SVOCs (µg/kg)							
Butylbenzylphthalate	330	62	J	60	J	***4900***	**J**

Notes:

BOLD Concentration meets criteria for observed release as given in HRS Table 2-3 (Ref. 1) (three times background concentrations or detection with non-detect background), with consideration of data qualifiers (Ref. 33).

CRDL Contract Required Detection Limit
L Analyte is present, but reported value may be biased low.
SD Sediment
HER Hermespota Creek
B Not detected at levels substantially above the level reported in the associated blanks.
J Analyte is present, but reported value may not be accurate.
ND Not detected
BK Background

Samples of sediment and surface water collected from the surface-water migration pathway during other investigations document an observed release to surface water. Those investigations were conducted in 1983 and 1988. The sections presented below document observed releases to surface water by chemical analysis for each of those investigations.

1983 Site Investigation - Observed Release to Surface Water by Chemical Analysis

On September 7, 1983 aqueous and sediment samples were collected from Hermesprota Creek (Ref. 20, pp. 1-1 and 1-2). Chemical analysis of the document an observed release of hazardous substances to surface water. A discussion of the background samples and release samples is provided below.

1983 Background Samples

The sample identified as upstream Hermesprota Creek was used as background (Ref. 20, p. 6-1-1). The background sample is located upstream of the Folcroft Landfill and Annex as shown on Figure 17. The background sample was analyzed for TAL inorganic compounds and TCL organic compounds (Ref. 20, Section 6). The depth at which the background sample was collected was not identified.

TABLE SW-17
BACKGROUND SAMPLES FOR HERMESPROTA
1983 SITE INVESTIGATION

Sample ID	Sample Location	Date	Reference
Upstream Hersmesprota Creek C3305/C3306 MC1178/MC1200	Upstream Hermesprota Creek - south of Tribbet Road	9/7/83	20, p. 6-1-1, Appendix B, p. B-3, and p. 5-2.

1983 Contaminated Samples

The results of the analysis of aqueous and sediment samples collected from Hermesprota Creek document an observed release to surface water. Table SW-18 summarizes the locations from which and the dates on which the samples were collected. The depths from which the contaminated sediment samples were collected was not identified. One sediment and one aqueous sample were collected from a ponded area at Folcroft Annex (Ref. 20, pp. 6-1-4 and B-3). The sample of ponded water was collected at the base of the Folcroft Annex in a wetland adjacent to Hermesprota Creek (Figure 17) (Ref. 20, p. B-3). Figure 17 shows the locations from which the samples were collected.

TABLE SW-18
CONTAMINATED SAMPLES FROM HERSMESPROTA
1983 SITE INVESTIGATION

Sample ID	Sample Location	Date	Reference
Hermesprota Creek Samples			
Downstream Hermesprota Creek	South of Folcroft Landfill Annex and on the southwestern boundary of the Folcroft Landfill	9/7/83	20, p. 5-2 and Appendix B, p. B-3.
Ponded water	The marsh located at the base or southern boundary of the Folcroft Landfill Annex	9/7/83	20, p. 5-2 and Appendix B, p. B-3.

A copy of Figure 17 is available at the EPA Headquarters Superfund Docket:

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1235 Jefferson Davis Highway
Arlington, VA 22202

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1983 SI Observed Release to Hermesprota Creek

Table SW-19 provides a summary of the concentrations of inorganic hazardous substances detected in the background and in the observed release aqueous and sediment samples collected from Hermesprota Creek in 1983. Those concentrations of hazardous substances that appear in the table in bold and italic type meet the analytical criteria for documentation of an observed release to surface water by chemical analysis (Ref. 1, pp. 51589 and 51609). No significant concentrations of organic compounds were detected in the release (contaminated) samples collected from Hermesprota Creek (Ref. 20, p. 6-1-1 to 6-1-3; Ref. 21, Attachment 1, pp. A-2 through A-4).

TABLE SW-19
SUMMARY OF INORGANIC COMPOUNDS DETECTED IN HERMESPROTA CREEK
1983 SITE INSPECTION

Sample Locations	Detection Limits[a]	Upstream (background)	Downstream	Ponded Water	References
Inorganic Compounds					
Hermesprota Creek (aqueous) (ppb)					
Arsenic	10	ND	***12***	***57***	20, pp. 6-1-4, D-25, D-27, D-33
Cadmium	5	ND	ND	***13***	20, p. 6-1-4, D-25, D-27, D-33
Lead	3	ND	***55***	***1260***	20, p. 6-1-4, D-25, D-27, D-33
Aluminum	200	339	***11000***	***144000***	20, p. 6-1-5, D-25, D-27, D-33
Chromium	10	ND	***34***	***340***	20, p. 6-1-5, D-25, D-27, D-33
Barium	200	ND	***208***	***1570***	20, p. 6-1-5, D-25, D-27, D-33
Cobalt	50	<50	<50	***88***	20, p. 6-1-5, D-25, D-27, D-33
Copper	25	<50	<50	***479***	20, p. 6-1-5, D-25, D-27, D-33
Iron	100	1340	***14000***	***247000***	20, p. 6-1-5, D-25, D-27, D-33
Nickel	40	ND	ND	***214***	20, p. 6-1-5, D-25, D-27, D-33
Manganese	15	107	***796***	***5840***	20, p. 6-1-5, D-25, D-27, D-33
Zinc	20	27	***206***	***2600***	20, p. 6-1-5, D-25, D-27, D-33
Vanadium	50	<200	<200	***359***	20, p. 6-1-5, D-25, D-27, D-33,
Hermesprota Creek (sediment) ppm					
Cyanide	2	820	***5600***	***4560***	20, p. 6-1-4, D-26, D-28, D-34

BOLD The concentration meets criteria for an observed release as set forth in HRS Table 2-3 (Ref. 1) (three times background concentration or detection with a nondetect background), with consideration of data qualifiers (Ref. 33).

[a] The samples were analyzed through the CLP (Ref. 20, p. 6-2). Therefore, the detection limits are the contract-required quantitation limits (CRQL) for organic substances and contract-required detection limits (CRDL) for inorganic substances (Ref. 1, p. 51589, Table 2-3). The CRQLs and CRDLs were obtained from Reference 35, pages A-3, A-9, and A-15.

ND Not detected above detection limit.

ppb Parts per billion

ppm Parts per million

Aqueous samples collected from Hermesprota Creek revealed concentrations of inorganic compounds at levels that exceeded levels equal to or greater than three times the background concentration, including: arsenic, cadmium, lead, aluminum, chromium, barium, cobalt, copper, iron, nickel, manganese, zinc, and vanadium. Samples of sediment revealed concentrations of cyanide at levels that exceeded levels equal to or greater than three times the background concentration (Ref. 20, pp. 6-1-4 through 6-1-5; Appendix B, pp. B-3; and Appendix D, pp. D-25, D-26, D-27, D-28, D-33, and D-34). The analytical data from samples collected in Hermesprota Creek indicate that the concentrations of numerous metals in the surface water of Hermesprota Creek downstream from the Folcroft Landfill and Annex are significantly higher than those in samples collected upstream of the landfills. The data indicate that the landfills are a source of inorganic contamination to Hermesprota Creek.

1988 SI - Observed Release to Surface Water by Chemical Analysis

In 1988, EPA and FWS conducted a joint SI as a follow-up to SI and sampling efforts that had been conducted at the Folcroft Landfill and Annex between October 1980 and February 1986 by EPA (Ref. 24, p. I-1). The SI included the collection of samples of sediment and surface water from Darby Creek (tidal marsh) and Hermesprota Creek (Ref. 24, p. III-18, Figure III-4 and p. III-23, Figure III-6). The samples were analyzed for general physical and chemical parameters, TAL metals, and TCL organic substances. Sediment samples were collected from intertidal and subtidal sediment (Ref. 24, p. I-1). Results of analysis of the subtidal sediment samples document an observed release to Darby Creek and Hermesprota Creek and are summarized in the sections below. No background sample was collected for the intertidal sediment samples. Therefore, results of analysis of those samples were not evaluated for an observed release.

1988 Background and Contaminated Samples of Subtidal Surface Sediment

During the 1988 investigation, nine samples of subtidal sediment were collected at locations shown on Figure 18. Subtidal sediments are submerged soils found on stream banks and bottoms below the low tide level. The samples were collected during the week of November 10 to 17, 1987. The exact date on which each sample was collected is not provided in the report. The samples were analyzed for TCL inorganic and TAL organic substances (Ref. 24, p. III-23 and p. IV-25, Figure III-6). One of the samples, COB-1, was collected adjacent to the Clearview Landfill (Ref. 24, p. III-23, Figure III-6). Sample DAR-5 was selected as the background sample for Darby Creek, and sample HER-2 was selected as the background sample for Hermesprota Creek (Ref. 24, p. III-29 and p. III-25, Figure III-6). Those samples are considered background for the following reasons:

- They were collected upstream of the sources on the Lower Darby Creek site (Ref. 24, p. III-25, Figure III-6)
- They were collected from the same surface water bodies (similar flow and depositional environment) and the same environmental setting as those from which the contaminated samples were collected (Ref. 24, p. III-25, Figure III-6)
- The same procedures were used in collecting and analyzing the background and the contaminated samples (Ref. 24, pp. II-8, III-1, III-23, III-24, III-26, and Appendix A)
- The background and the contaminated samples were collected during the same time frame, the week of November 10 to 17, 1987 (Ref. 24, p. III-23)
- Both the background and the contaminated samples are subtital surface sediment samples (Ref. 24, p. III-27)
- The background and the contaminated samples have similar physical and chemical properties (Ref. 24, p. III-27)

A copy of Figure 18 is available at the EPA Headquarters Superfund Docket:

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Tables SW-20 and SW-21 summarize the sample identifications, sample locations, and depths for the background and the contaminated samples.

TABLE SW-20
BACKGROUND SAMPLES FOR SAMPLES OF SUBTIDAL SURFACE SEDIMENT SAMPLES
1988 SITE INVESTIGATION

Sample ID	Sample Location	Depth	Reference
Hermesprota Creek			
HER-2	Upstream of the Folcroft Landfill and Annex	Surface	Ref. 24, p. II-2, Figure II-1, p. III-23, p. III-25, Figure III-6, and p. III-29, Table III-10; Figure 18 of this HRS Documentation Record
Darby Creek			
DAR-5	Upstream of the Lower Clearview Landfill	Surface	Ref. 24, p. II-2, Figure II-1, p. III-23, p. III-25, Figure III-6, and p. III-29, Table III-10; Figure 18 of this HRS Documentation Record

TABLE SW-21
CONTAMINATED SAMPLES OF SUBTIDAL SURFACE SEDIMENTS
1988 SITE INVESTIGATION

Sample ID	Sample Location	Depth	Reference
DAR-1	Darby Creek, downstream of all sources in the Lower Darby Creek Area	Surface	24, p. III-2, Figure II-1, p. III-23, p. III-25, Figure III-6, p. III-29, Table III-10 and Figure 18 of this HRS Documentation Record
DAR-2	Darby Creek, downstream from all sources in the Lower Darby Creek Area	Surface	24, p. III-2, Figure II-1, p. III-23, p. III-25, Figure III-6, p. III-29, Table III-10 and Figure 18 of this HRS Documentation Record
DAR-3	Darby Creek, downstream of the Clearview Landfill, the Incinerator Landfill, the Sewage Sludge Area, the Catalyst Disposal Area, the Oily Sludge Disposal Area, and the Industrial Drive Properties	Surface	24, p. III-2, Figure II-1, p. III-23, p. III-25, Figure III-6, p. III-29, Table III-10 and Figure 18 of this HRS Documentation Record
DAR-4	Darby Creek, downstream of the Clearview Landfill (at Hook Road)	Surface	24, p. III-2, Figure II-1, p. III-23, p. III-25, Figure III-6, p. III-29, Table III-10 and Figure 18 of this HRS Documentation Record
IMP-1	Impoundment (connected to Darby Creek by 2-3 sluice gates)	Surface	24, p. III-2, Figure II-1, p. III-23, p. III-25, Figure III-6, p. III-29, Table III-10 and Figure 18 of this HRS Documentation Record
HER-1	Hermesprota Creek, downstream of the Folcroft Landfill and Annex	Surface	24, p. III-2, Figure II-1, p. III-23, p. III-25, Figure III-6, p. III-29, Table III-10 and Figure 18 of this HRS Documentation Record

1988 Contaminated Samples of Subtidal Surface Sediment

The samples of subtidal surface sediment were analyzed for TCL inorganic and TAL organic substances (Ref. 24, p. III-23 and p. III-25, Figure III-6). One of the samples, COB-1, was collected adjacent to the Clearview Landfill (Ref. 24, p. II-2, Figure II-1 and p. III-25, Figure III-6). Table SW-22 provides a summary of the concentrations of organic and inorganic hazardous substances detected in the background and in the release aqueous and sediment samples collected from Darby Creek and Hermesprota Creek in 1988. Concentration of hazardous substances that appear in the table in bold and italic type meet the analytical criteria for documentation of an observed release to surface water by chemical analysis (Ref. 1, pp. 51589 and 51609).

TABLE SW-22
SUMMARY OF COMPOUNDS DETECTED IN SAMPLES OF SUBTIDAL SEDIMENT
FROM DARBY AND HERMESPROTA CREEKS

Sample ID	Detection Limit	DAR-5 background	DAR-4	DAR-3	DAR-2	DAR-1	HER-2 background	HER-1	IMP-1
Organic Compounds (μg/kg)									
Phenanthrene	4,800	DB	***7,000***	DB	DB	ND	DB	DB	DB
Fluoranthene	4,800	DB	***6,900***	DB	DB	ND	2700	DB	DB
Pyrene	4,800	DB	4,600	DB	DB	ND	DB	DB	DB
Inorganic Compounds (mg/kg)									
Arsenic	0.009	12.2	2.2	11.2	***50.5***	24.0	22.0	13.2	13.4
Iron	0.019	26,500	12,000	27,500	32,400	26,500	18,900	***78,300***	28,500
Lead	0.038	39.7	54.7	***403***	97.6	17.0	197	***640***	***247***
Manganese	0.014	560	95.2	603	537	425	264	***1400***	463
Mercury	0.0002	0.5	ND	0.5	0.6	0.1	0.1	***1.0***	0.3
Nickel	0.020	24.4	12.4	33.3	26.9	25.8	18.2	***228***	26.8
Selenium	0.005	2.1	1.2	ND	2.4	2.6	ND	***5.7***	ND
Silver	0.010	ND	ND	ND	ND	ND	ND	***4.4***	ND
Zinc	0.010	82.4	91.9	***337***	***360***	81.2	228	***811***	161

BOLD The concentration meets criteria for an observed release as set forth in HRS Table 2-3 (Ref. 1) (three times background concentration or detection with a nondetect background), with consideration of data qualifiers (Ref. 33).

ND None detected
IMP Impoundment
DB Detected at a level lower than quantifiable level
mg/kg Milligrams per kilogram
DAR Darby Creek
HER Hermesprota Creek
μg/kg Microgram per kilogram

Reference: 24, p. III-30, Table III-11, and p. III-29, Table III-10 and Table B-1

The highest concentrations and the largest number of metals detected in the samples of subtidal sediment samples were detected in sample HER-1, collected in Hermesprota Creek downstream of the Folcroft Landfill and Annex (Ref. 24, p. III-25, Figure III-6) (Figure 18).

1988 Background and Release Samples of Surface Water

During the 1988 investigation, samples of surface water were collected from the same 9 locations from which samples of subtidal sediment were collected. Figure 19 shows the locations from which the 9 samples were collected. All the samples were collected during falling tides on April 28 to 29, 1988 (Ref. 24, p. III-36). The samples were analyzed for TCL organic and TAL inorganic compounds (Ref. 24, p. III - 38). The samples of surface water were collected at the same location from which samples of subtidal sediment were collected. Table SW-23 provides a summary of compounds detected in the release and the background samples.

The analytical data from the samples of surface water indicate that the Folcroft Landfill and Annex are releasing aluminum and barium to surface water.

TABLE SW-23
SUMMARY OF INORGANIC COMPOUNDS DETECTED IN THE SAMPLES OF SURFACE WATER
DARBY AND HERMESPROTA CREEKS
1988 SITE INVESTIGATION

Sample ID	Detection Limit	DAR-5 Background	DAR-4	DAR-3	DAR-2	DAR-1	HER-2 background	HER-1
Inorganic Compounds (μg/l)								
Aluminum	160	2.04	2.32	0.94	0.66	0.95	0.37	***1.65***
Barium	16	ND	***0.22***	ND	***0.21***	***0.27***	ND	ND

BOLD The Concentration meets criteria for an observed release as set forth in HRS Table 2-3 (Ref. 1) (three times background concentration or detection with a nondetect background), with consideration of data qualifiers (Ref. 33).

ND None Detected.

Reference: 24, p. III-42, Table III-4, and Appendix B, Table B-1

A copy of Figure 19 is available at the EPA Headquarters Superfund Docket:

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Attribution

The two sections below discuss the attribution to sources located at the Lower Darby Creek Area of hazardous substances detected in surface water or sediment samples at concentrations equal to or greater than three times background concentrations (or detection with non-detect background).

Darby Creek

Investigations of the contamination in Darby Creek document the presence of metals, Aroclor 1242, and PAHs in the surface water or the sediments of Darby Creek (see Section 4.1.2.1.1). The investigations revealed the presence of those contaminants in Darby Creek between Clearview Landfill (Source 1), the most upstream source, and the Folcroft Landfill and Annex, the most downstream source. Those contaminants were detected in samples from the seven sources (see Sections 2.4.1). Surface runoff from the sources located within the LDCA drain to Darby Creek (see Section 4.1.1.1). Because the contamination in Darby Creek is documented in the area between the sources and the contaminants are present in each source within the LDCA site, it is not possible to identify which of the seven sources within the LDCA site caused the release to Darby Creek. It is only possible to determine that a release or the presence of the contaminants in Darby Creek is at least partially attributable to each of the seven sources within the LDCA site. The table below summarizes the contaminants detected in samples obtained from the sources within the LDCA and documented to be present in the observed release to Darby Creek. The "X" under aqueous sample and sediment sample indicate that the contaminant was detected in an aqueous or sediment sample from Darby Creek at a concentration that documents an observed release. The observed release samples are documented in Tables SW-12, SW-14, SW-22, and SW-23. The contaminants detected in the source samples are documented in Section 2.4.1.

TABLE SW-24
CONTAMINANTS DETECTED SOURCE SAMPLES AND IN DARBY CREEK DOWNSTREAM OF SOURCES 1 THROUGH 7

Contaminant	Aqueous Sample	Sediment Sample	Detected in Source
Inorganics			
Aluminum	X		2, 5
Antimony		X	1, 2, 7
Arsenic	X	X	1, 2, 4, 7
Barium	X	X	1, 2 ,5, 7
Cadmium	X	X	1, 2, 5, 7
Copper	X		2, 3
Iron	X		1, 2, 5, 7
Lead		X	1, 2, 5, 6, 7
Manganese	X	X	2
Mercury	X		1, 2, 3, 4, 5, 7
Silver		X	1, 2, 5, 6, 7
Vanadium	X		3, 5, 7

TABLE SW-24 (Contined)
CONTAMINANTS DETECTED SOURCE SAMPLES AND IN DARBY CREEK DOWNSTREAM OF SOURCES 1 THROUGH 7

Contaminant	Aqueous Sample	Sediment Sample	Detected in Source
Inorganics			
Zinc	X	X	1, 2, 3, 7
Organics			
Phenanthrene		X	1, 2, 3, 4, 5, 6, 7
Fluoranthene		X	1, 2, 3, 5, 6, 7
Pyrene		X	1, 2, 3, 5, 6, 7

As the table above shows, many of the contaminants detected in the observed release to Darby Creek were also detected in over four of the seven sources.

In addition to the presence of the same contaminants in the seven sources and in Darby Creek, all seven sources within the LDCA site are located adjacent to Darby Creek or a tributary of Darby Creek, within the Darby Creek watershed (see Sections 2.2). Therefore, all these sources affect the same targets, fisheries, wetlands, and other sensitive environments in Darby Creek. Aerial photographs show that the locations of the sources were either within wetlands or tributaries of Darby Creek as documented below:

. Clearview Landfill (Source 1) - The Clearview Landfill was created by filling wetlands and tributaries of Darby Creek (Ref. 4, pp. 6, 7, 8, 9, 10, 11, 13, 14, 15, 16, and 17).

. Industrial Drive Properties (Source 2) - A 1953 aerial photograph of the Industrial Drive properties show tributaries flowing throughout the property (Ref. 37, pp. 8 and 9). Latter aerial photographs show the tributaries to be filled in (Ref. 37, pp. 11 and 13). Industrial Drive Properties was a former wetland of Darby Creek that has been filled in.

. The Oily Sludge Disposal Area (Source 3) - The aerial photographs of the Oily Sludge Disposal Area show the area as a wetland of Darby Creek (Ref. 37, pp. 13 and 14). The disposal area filled in the wetland.

. The Catalyst Disposal Area (Source 4) - An aerial photographic interpretation of this source is not available. However, the area is evident on aerial photographs of the Oil Sludge Disposal Area. The source was formerly a pond or basin that was filled in (Ref. 37, pp. 9, 13, 17, and 21; Ref. 73, p. 1).

. The Sewage Sludge Disposal Area (Source 5) - The Sewage Sludge Disposal Area was located in a wetland of Darby Creek (Ref. 37, pp. 24 to 25).

. The Former Delaware County Incinerator Landfill (Source 6) - The incinerator landfill filled in wetland areas of Hermesprota Creek (Ref. 31, p. 6 to 7; Ref. 32, p. 2). Hermesprota Creek drains to Darby Creek (Ref. 34).

. Folcroft Landfill and Annex (Source 7) - The Folcroft Landfill and Annex filled in more than 63 acres of Darby Creek wetlands (Ref. 24, p. II-3; Ref. 37, p. 33).

This information indicates that each of the sources within LDCA filled in wetland areas associated with the Darby Creek watershed.

Hermesprota Creek

Two sources at the site are expected to discharge to Hermesprota Creek: the former Delaware County Incinerator Landfill (Source 6) and the Folcroft Landfill and Annex (Source 7). Hazardous substances detected both in samples from the sources and in observed release samples of surface water or sediment collected from Hermesprota Creek downstream of the sources are: arsenic, barium, cadmium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, vanadium, and zinc (see Sections 2.4.1 for hazardous substances associated with the sources and Section 4.1.2.1.1 of the Documentation Record).

4.1.2.3 DRINKING WATER TARGETS

No drinking water targets major or designated recreational areas have been identified within the TDL. The threat to drinking water targets was therefore it is not evaluated.

4.1.3.2 WASTE CHARACTERISTICS

The waste characteristics factor category for the threat to the human food chain is evaluated on the basis of the HWQ and the toxicity, persistence and bioaccumulation of hazardous substances available to migrate to surface water. Those factors and the waste characteristics factor category value for the threat to the human food chain are discussed below.

4.1.3.2.1 Toxicity/Persistence/Bioaccumulation

Hazardous substances known to be associated with sources evaluated at the Lower Darby Creek Area include organic and inorganic compounds. Toxicity, persistence, and bioaccumulation factor values for those hazardous substances are summarized in the table below and were obtained from the Superfund Chemical Data Matrix (ref. 2). The toxicity and persistence factor values were obtained from HRS Table 4-12 (ref. 1, p. 51613) and the toxicity, persistence, and bioaccumulation factor values were obtained from HRS Table 4-16 (ref. 1, p. 51619).

TABLE SW-25
TOXICITY/PERSISTENCE/BIOACCUMULATION FACTOR VALUES

Hazardous Substance	Source No.	Toxicity Factor Value	Persistence Factor Value	Food Chain Bioaccumulation Factor Value	Toxicity/ Persistence/ Bioaccumulation Factor Value	Ref.
Inorganic Compounds						
Aluminum	2,5	- -[a]	1	--	--	2
Antimony	1,2,7	10,000	1	0.5	5,000	2
Arsenic	1,2,4,7	10,000	1	5	5×10^4	2
Barium[b]	1,2,5,7	10,000	1	0.5	5,000	2
Cadmium	1,2,5,7	10,000	1	5,000	5×10^7	2
Chromium	2,5,7	10,000	1	5	5×10^4	2
Cobalt	2,3	1	1	0.5	0.5	2
Copper	1,2,3,5,6,7	- -[a]	1	50,000	- -	2
Cyanide	2	100	0.4	0.5	20	2
Iron[b]	1,2,5,7	1	1	0.5	0.5	2
Lead	1,2,5,6,7	10,000	1	50	5×10^5	2
Magnesium[b]	2,5,7	- -[a]	1	0.5	- -	2
Manganese[b]	2	10,000	1	0.5	5,000	2
Mercury	1,2,3,4,5,7	10,000	0.4	50,000	2×10^8	2
Nickel	1,2,3,5,7	10,000	1	0.5	5,000	2
Selenium	1,2,7	100	1	5,000	5×10^5	2
Silver	1,2,5,7	100	1	50	5,000	2
Vanadium[b]	3,5,7	100	1	0.5	50	2
Zinc	1,2,3,7	10	1	500	5,000	2

TABLE SW-25
TOXICITY/PERSISTENCE/BIOACCUMULATION FACTOR VALUES

Hazardous Substance	Source No.	Toxicity Factor Value	Persistence Factor Value	Food Chain Bioaccumulation Factor Value	Toxicity/ Persistence/ Bioaccumulation Factor Value	Ref.
Organic Compounds						
Acenaphthene	1,7	10	0.4	500	2,000	2
Anthracene	1,2,3,5,7	10	1	5,000	5×10^4	2
Benzo(a)anthracene	1,5,7	1,000	1	50,000	5×10^7	2
Benzo(a)pyrene	1,2,3,4,5,7	10,000	1	50,000	5×10^8	2
Benzo(b)fluoranthene	1,3,5,7	1,000	1	50,000	5×10^7	2
Benzo(g,h,i)perylene	1,2,3,4,5,7	- -[a]	1	50,000	- -	2
Benzo(k)fluoranthene	1,2,4,5,6,7	100	1	50,000	5×10^6	2
Butylbenzylphthalate	1,2	10	1	500	5,000	2
Carbazole	1,2,5	10	0.4	500	2,000	2
Chlorobenzene	7	100	0.0007	50	3.5	2
Chrysene	1,2,3,5,7	10	1	500	5,000	2
Dibenz(a,h)anthracene	2,5	10,000	1	50,000	5×10^8	2
Dibenzofuran	7	- -[a]	1	500	- -	2
Fluoranthene	1,2,3,5,7	100	1	5,000	5×10^5	2
Fluorene	1,3,7	100	1	5,000	5×10^5	2
Indeno(1,2,3-cd)pyrene	1,2,5,7	1,000	1	50,000	5×10^8	2
2-Methylnaphthalene	1,2,7	- -[a]	0.4	5,000	- -	2
Naphthalene	1,2,7	100	0.4	500	2×10^4	2
Phenanthrene	1,2,3,4,5,7	- -[a]	1	50	- -	2
Pyrene	1,2,3,5,7	100	1	50	5,000	2
Pesticides/PCBs						
Aroclor-1248	1	10,000	1	50,000	5×10^8	2
Aroclor-1254	1	10,000	1	50,000	5×10^8	2
Aroclor-1260	1,5	10,000	1	50,000	5×10^8	2
Dioxin	6	10,000	1	50,000	5×10^8	2

Notes:

[a] No factor value provided in the Superfund Chemical Data Matrix.
[b] This contaminant is not listed as a hazardous substance under CERCLA, as set forth in 40 CFR 302.4, but is a CERCLA pollutant or contaminant according to the HRS (ref. 1).

==========

Toxicity/Persistence/Bioaccumulation Factor Value: 5×10^8

4.1.3.2.2 Hazardous Waste Quantity

HWQ values assigned to each source evaluated within the Lower Darby Creek Area are listed below (see Section 2.4.2.1.5 of the HRS documentation record). The HWQ factor value for the surface water pathway was determined from HRS Table 2-6 (Ref. 1, p. 51591).

TABLE 26
HAZARDOUS WASTE QUANTITY VALUES - FOOD CHAIN

Source Number	Source Name	Source HWQ Value	Is Source Hazardous Waste Quantity Data Complete?
1	Clearview Landfill	832.77	No
2	Industrial Drive Properties	>0	No
3	Oil Sludge Disposal Area	83.97	No
4	Catalyst Disposal Area	7.61	No
5	Sewage Sludge Disposal Area	4.48	No
6	Delaware County Incinerator Landfill	192.18	No
7	Folcroft Landfill and Annex	819.95	No

HWQ Total = 1,940.96

The assigned HWQ factor value for the surface water migration pathway is 100 (Ref. 1, p. 51591, Table 2-6).

4.1.3.2.3 Waste Characteristics Factor Category Value

The waste characteristics factor category value is obtained by multiplying the highest toxicity, persistence, and bioaccumulation factor value by the HWQ factor value (Ref. 1, p. 51620). The product is assigned a waste characteristics factor category value form HRS Table 2-7 (Ref. 1, p. 51592).

The highest toxicity, persistence, and bioaccumulation factor values assigned to the surface water migration pathway were for benzo(a)pyrene, dibenz(a,h)anthracene, indeno(1,2,3-cd)pyrene, Aroclor-1248, Aroclor-1254, Aroclor-1260, and dioxin, which have a toxicity factor value of 10,000, a persistence factor value of 1, and a bioaccumulation factor value of 50,000 (Ref. 2).

Toxicity/Persistence/Bioaccumulation factor value (5×10^8) × HWQ factor value (100) = 5×10^{10}

A waste characteristics factor category value of 320 was assigned from HRS Table 2-7 (Ref. 1, p. 51592).

Hazardous Waste Quantity Assigned Value: 5×10^{10}
Waste Characteristics Category Value: 320

4.1.3.3 HUMAN FOOD CHAIN THREAT-TARGETS

A variety of hazardous substances, including organic and inorganic compounds that have a bioaccumulation factor values of 500 or more, have been detected in aqueous and sediment samples of Darby Creek and Hermesprota Creek. There is no documentation that Hermesprota Creek is used for fishing. Darby Creek is used for recreational fishing (Ref. 80). Information indicates that Darby Creek is used as a fishery in the John Heinz NWR and provides habitat for numerous fish species, including muskellunge, large-and small-mouth bass, striped bass, and catfish. In addition, Darby Creek is stocked with at least 10,000 trout each year (Ref. 80). Darby Creek and the surrounding John Heinz NWR also provides habitat for migrating birds and waterfowl (Ref. 36, p. III-14; Ref. 24, p. II-6). The extent and level of contamination of the human food chain in Darby Creek is discussed below.

Actual Food Chain Contamination - Darby Creek

An observed release of hazardous substances that have a bioaccumulation factor values of 500 or more has been documented to Darby Creek by both direct observation and chemical analysis as documented in Section 4.1.2.1.1 and Table SW-27. Numerous site inspections were conducted in the Lower Creek Darby Creek Area as summarized in Section 4.1.2.1.1. The most recent site inspection occurred in 1998. This investigation is used to document the presence of a Level II fishery. The other investigations are not used to document a Level II fishery because the investigations do not have the most recent analytical data and the 1998 site inspection documents the greatest extent of a Level II fishery in Darby Creek. The other site investigations also document the presence of a Level II fishery in Darby Creek. Figure 16 shows the location from which the 1998 surface water and sediment samples were collected. The following sediment samples contained hazardous substances at concentrations that meet the criteria for an observed release and that have bioaccumulation factor values of 500 or more: SD-46, SD-47, and SD-52 (see Section 4.1.2.1.1, Table SW-14 and Table SW-27). The following surface water samples contained hazardous substances at concentrations that meet the criteria for an observed release and that have bioaccumulation factor values of 500 or more: SW-38, SW-49, SW-50, and SW-54 (see Section 4.1.2.1.1, Table SW-12, Table SW-25, and Table SW-27). The most upstream sample is sample number 38 and the most downstream sample is sample number 54. All other sample locations fall between these two locations (Ref. 31, Figure 7) (Figure 16). Because there are multiple sources and multiple PPEs to surface water, the extent of the Level II fishery is taken as the distance between sample number 38 and 54. Sample number 38 is downstream from all the PPEs expect for the PPE for the Folcroft Landfill and Annex. All other Level II sample locations are downstream of all the PPEs to surface water (see Section 4.1.1.1 and Figure 16).

The distance between each sample starting from upstream to downstream is summarized in Table 27. Sample number 38 is the most upstream sample. Distances between sample locations were measured on Figure 7 in Reference 31.

TABLE SW-27
EXTENT OF ACTUAL CONTAMINATION OF THE HUMAN FOOD CHAIN

Sample Number	Distance from Sample Number 38 (feet)	Hazardous Substance	Bioaccumulation Potential Factor Value
38	0	Cadmium	5,000
47	2,240	Cadmium	5,000
46	2,880	Cadmium	5,000
46	2,880	Aroclor-1242	50,000
50	5,280	Mercury	50,000
50	5,280	Zinc	500
49	7,040	Cadmium	5,000
52	10,240	Cadmium	5,000
54	14,400	Cadmium	5,000

Closed Fishery

No closed fisheries have been documented within the TDL. A fish warning is posted at the John Heinz NWR, however, the reason for the posting is not related to any specific contamination (Ref. 80). The actual reason for posting has not been determined.

Benthic Tissue

No samples of benthic tissue have been collected from Darby Creek to document actual contamination of the human food chain.

Level I Concentrations

No level I concentrations have been documented in Darby Creek.

Sample ID: NA
Sample Medium: NA
Location: NA

Level II Fisheries

Section 4.1.2.1.1 documents an observed release to surface water and sediments of Darby Creek of hazardous substances that have bioaccumulation factor values of 500 or more, therefore, a Level II fishery in Darby Creek has been documented. The hazardous substances that meet the criteria for an observed release, and that have bioaccumulation factor values of 500 or more, include Aroclor-1254, cadmium, mercury, and zinc.

4.1.3.3.1 Food Chain Individual

Observed releases of hazardous substances to Darby Creek from the Lower Darby Creek Area have been documented by both direct observation and chemical analysis of aqueous and sediment samples collected from Darby Creek (see Section 4.1.2.1.1). Those hazardous substances present in observed releases that have bioaccumulation potential factor values of 500 or more are listed in Table SW-28. Darby Creek is used for recreational fishing (Ref. 80). Information indicates that Darby Creek is used as a fishery in the John Heinz NWR and provides habitat for numerous fish species, including muskellunge, large-and small-mouth bass, striped bass, and catfish. In addition, Darby Creek is stocked with at least 10,000 trout each year (Ref. 80). The presence of hazardous substances in surface water and sediment of Darby Creek at levels documenting an observed release and with a bioaccumulation factor value of 500 or more document the presence of a Level II fishery in Darby Creek. A food chain individual factor value of 45 therefore was assigned as specified in HRS Section 4.1.3.3.1 (Ref. 1, p. 51620).

TABLE SW-28
HUMAN FOOD CHAIN INDIVIDUAL

Hazardous Substance	Surface Water	Bioaccumulation Potential Factor Value	Reference
Aroclor-1242	Darby Creek	50,000	2
Cadmium	Darby Creek	5,000	2
Mercury	Darby Creek	50,000	2
Zinc	Darby Creek	500	2

==========

Food Chain Individual: 45

4.1.3.3.2 Population

4.1.3.3.2.1 Level I Concentrations

Identify of Fishery	Annual Production (pounds)	Reference	Human Food Chain Population Value
NA			

Sum of Human Food Chain Population Values: 0

==========

Level I Concentration Factor Values: 0

4.1.3.3.2.2 Level II Concentrations

Level II concentrations have been documented in Darby Creek and Darby Creek is used for recreational fishing. Darby Creek is stocked with trout upstream of the Lower Darby Creek Area (Ref. 80; Ref. 36, p. II-5). No data on pounds of fish or number of fish caught per year have been identified. The annual production in pounds for Darby Creek is therefore greater than zero.

TABLE SW-29
HUMAN FOOD CHAIN POPULATION VALUE

Identity of Fishery	Annual Production (pounds)	Reference	Human Food Chain Population Value
Darby Creek	>0	80	0.03

Sum of Human Food Chain Population Values: 0.03

==========

Level II Concentration Factor Values: 0.03

4.1.3.3.2.3 Potential Human Food Chain Contamination

The surface water TDL for the Lower Darby Creek Area includes: Hermesprota Creek, Darby Creek, and the Delaware River. Fisheries within the TDL are subject to potential contamination of the human food chain. Fishery production data for those bodies of surface water are not complete or have not been identified. The inclusion of the potential human food chain contamination is expected to have a minimal affect on the site score. The value for the potential human food chain contamination therefore has not been scored.

4.1.4.2 WASTE CHARACTERISTICS

The waste characteristics factor category for the environmental threat is evaluated on the basis of the HWQ and the ecosystem toxicity, persistence and bioaccumulation of hazardous substances available to migrate to surface water. Those factors and the waste characteristics factor category value for the environmental threat are discussed below.

4.1.4.2.1 Ecosystem Toxicity/Persistence/Bioaccumulation

Hazardous substances known to be associated with sources evaluated at the Lower Darby Creek Area include organic and inorganic compounds. Toxicity and persistence factor values for those hazardous substances are summarized in the table below and were obtained from the SCDM (ref. 2). The toxicity and persistence factor values were obtained from HRS Table 4-29 (Ref. 1, p. 51639).

TABLE SW-30
ECOSYSTEM TOXICITY/PERSISTENCE

Hazardous Substance	Source No.	Ecosystem Toxicity Factor Value	Persistence Factor Value	EcoToxicity/ Persistence Factor Value	Ref.
Inorganic Compounds					
Aluminum	2,5	100	1	100	2
Antimony	1,2,7	100	1	100	2
Arsenic	1,2,4,7	10	1	10	2
Barium[b]	1,2,5,7	1	1	1	2
Cadmium	1,2,5,7	1,000	1	1,000	2
Chromium	2,5,7	100	1	100	2
Cobalt	2,3	--[a]	1	--	2
Copper	1,2,3,5,6,7	100	1	100	2
Cyanide	2	1000	0.4	400	2
Iron[b]	1,2,5,7	10	1	10	2
Lead	1,2,5,6,7	1,000	1	1,000	2
Magnesium[b]	2,5,7	--[a]	1	--	2
Manganese[b]	2	--[a]	1	--	2
Mercury	1,2,3,4,5,7	10,000	0.4	4,000	2
Nickel	1,2,3,5,7	10	1	10	2
Selenium	1,2,7	1,000	1	1,000	2
Silver	1,2,5,6,7	10,000	1	10,000	2
Vanadium[b]	3,5,7	--[a]	1	--	2
Zinc	1,2,3,7	10	1	10	2

TABLE 30 (CONTINUED)
ECOSYSTEM TOXICITY/PERSISTENCE

Hazardous Substance	Source No.	Ecosystem Toxicity Factor Value	Persistence Factor Value	EcoToxicity/ Persistence Factor Value	Ref.
Organic Compounds					
Acenaphthene	1	10,000	0.4	4,000	2
Anthracene	1,2,3,5,7	10,000	1	10,000	2
Benzo(a)anthracene	1,5,7	10,000	1	10,000	2
Benzo(a)pyrene	1,2,3,4,5,7	10,000	1	10,000	2
Benzo(b)fluoranthene	1,3,5,7	--[a]	1	--	2
Benzo(g,h,i)perylene	1,2,3,4,5,7	--[a]	1	--	2
Benzo(k)fluoranthene	1,2,3,4,5,7	--[a]	1	--	2
Butylbenzylphthalate	1,2	100	1	100	2
Carbazole	1,2,5	--[a]	0.4	--	2
Chlorobenzene	7	1,000	0.0007	0.7	2
Chrysene	1,2,3,5,7	1,000	1	1,000	2
Dibenz(a,h)anthracene	2,5	--[a]	1	--	2
Dibenzofuran	7	100	1	100	2
Fluoranthene	1,2,3,5,7	10,000	1	10,000	2
Fluorene	1,3,7	1,000	1	1,000	2
Indeno(1,2,3-cd)pyrene	1,2,5,7	--[a]	1	--	2
2-Methylnaphthalene	1,2,7	1,000	0.4	400	2
Naphthalene	1,2,7	1,000	0.4	400	2
Phenanthrene	1,2,3,4,5,7	1,000	1	1,000	2
Pyrene	1,2,3,5,7	10,000	1	10,000	2
Pesticides/PCBs					
Aroclor-1248	1	10,000	1	10,000	2
Aroclor-1254	1	10,000	1	10,000	2
Aroclor-1260	1,5	10,000	1	10,000	2
Dioxin total	6	10,000	1	10,000	2

Notes:

[a] No factor value provided in the SCDM.

[b] This contaminant is not listed as a hazardous substance under CERCLA, as set forth in 40 CFR 302.4, but is a CERCLA pollutant or contaminant according to the HRS (ref. 1).

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EcoToxicity/Persistence Factor Value: 10,000

4.1.4.2.1 Ecosystem Toxicity/Persistence/Bioaccumulation

Hazardous substances known to be associated with sources evaluated at the Lower Darby Creek Area include organic and inorganic compounds. Toxicity, persistence, and bioaccumulation factor values for those hazardous substances are summarized in the table below and were obtained from the SCDM (Ref. 2). The toxicity, persistence, and bioaccumulation factor values were obtained from HRS Table 4-30 (Ref. 1, p. 51640).

TABLE 31
ECOSYSTEM TOXICITY/PERSISTENCE/BIOACCUMULATION

Hazardous Substance	Source No.	Ecosystem Toxicity/ Persistence Factor Value (Ref. 1, Table 4-20)	Ecosystem Bioaccumulation Factor Value (HRS Section 4.1.3.2.1.3)	Ecosystem Toxicity/ Persistence/ Bioaccumulation Factor Value (HRS Table 4-21)	Ref.
Inorganic Compounds					
Aluminum	2,5	100	50	5000	2
Antimony	1,2,7	100	5	500	2
Arsenic	1,2,4,7	10	500	5,000	2
Barium[b]	1,2,5,7	1	0.5	0.5	2
Cadmium	1,2,5,7	1,000	5,000	5×10^6	2
Chromium	2,5,7	100	5	500	2
Cobalt	2,3	--[a]	5,000	--	2
Copper	1,2,3,5,6,7	100	50,000	5×10^6	2
Cyanide	2	400	0.5	200	2
Iron[b]	1,2,5,7	10	0.5	5	2
Lead	1,2,5,6,7	1,000	5,000	5×10^6	2
Magnesium[b]	2,5,7	--[a]	0.5	--	2
Manganese[b]	2	--[a]	50,000	--	2
Mercury	1,2,3,4,5,7	4,000	50,000	2×10^8	2
Nickel	1,2,3,5,7	10	500	5,000	2
Selenium	1,2,7	1,000	5,000	5×10^6	2
Silver	1,2,5,6,7	10,000	50	5×10^5	2
Vanadium[b]	3,5,7	--[a]	0.5	--	2
Zinc	1,2,3,7	10	500	5,000	2

TABLE 31 (CONTINUED)
ECOSYSTEM TOXICITY/PERSISTENCE/BIOACCUMULATION

Hazardous Substance	Source No.	Ecosystem Toxicity/ Persistence Factor Value (Ref. 1, Table 4-20)	Ecosystem Bioaccumulation Factor Value (HRS Section 4.1.3.2.1.3)	Ecosystem Toxicity/ Persistence/ Bioaccumulation Factor Value (HRS Table 4-21)	Ref.
Organic Compounds					
Acenaphthene	1	4,000	500	2×10^6	2
Anthracene	1,2,3,5,7	10,000	5,000	5×10^7	2
Benzo(a)anthracene	1,5,7	10,000	50,000	5×10^8	2
Benzo(a)pyrene	1,2,3,4,5,7	10,000	50,000	5×10^8	2
Benzo(b)fluoranthene	1,3,5,7	--[a]	50,000	--	2
Benzo(g,h,i)perylene	1,2,3,4,5,7	--[a]	50,000	--	2
Benzo(k)fluoranthene	1,2,3,4,5,7	--[a]	50,000	--	2
Butylbenzylphthalate	1,2	100	500	5×10^4	2
Carbazole	1,2,5	--[a]	500	--	2
Chlorobenzene	7	0.7	50	35	2
Chrysene	1,2,3,5,7	1,000	5,000	5×10^6	2
Dibenz(a,h)anthracene	2,5	--[a]	50,000	--	2
Dibenzofuran	7	100	500	5×10^4	2
Fluoranthene	1,2,3,5,7	10,000	500	5×10^6	2
Fluorene	1,3,7	1,000	5,000	5×10^6	2
Indeno(1,2,3-cd)pyrene	1,2,5,7	--[a]	50,000	--	2
2-Methylnaphthalene	1,2,7	400	5,000	2×10^6	2
Naphthalene	1,2,7	400	500	2×10^5	2
Phenanthrene	1,2,3,4,5,7	1,000	5,000	5×10^6	2
Pyrene	1,2,3,5,7	10,000	50	5×10^5	2
Pesticides/PCBs					
Aroclor-1248	1	10,000	50,000	5×10^8	2
Aroclor-1254	1	10,000	50,000	5×10^8	2
Aroclor-1260	1,5	10,000	50,000	5×10^8	2
Dioxin	6	10,000	50,000	5×10^8	2

Notes: [a] No factor value provided in the SCDM.

[b] This contaminant is not listed as a hazardous substance under CERCLA, as set forth in 40 CFR 302.4, but is a CERCLA pollutant or contaminant according to the HRS (ref. 1).

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Ecosystem Toxicity/Persistence/Bioaccumulation Factor Value: 5×10^8

4.1.4.2.2 Hazardous Waste Quantity

HWQ values assigned to each source evaluated within the Lower Darby Creek Area are listed below (see Section 2.4.2.1.5 of the HRS documentation record). The HWQ factor value for the surface water pathway was determined from HRS Table 2-6 (Ref. 1, p. 51591).

TABLE SW-32
HAZARDOUS WASTE QUANTITY VALUES - FOOD CHAIN

Source Number	Source Name	Source HWQ Value	Is Source Hazardous Waste Quantity Data Complete?
1	Clearview Landfill	832.77	No
2	Industrial Drive Properties	>0	No
3	Oil Sludge Disposal Area	83.97	No
4	Catalyst Disposal Area	7.61	No
5	Sewage Sludge Disposal Area	4.48	No
6	Delaware County Incinerator Landfill	192.18	No
7	Folcroft Landfill and Annex	819.95	No

HWQ Total = 1,940.96

The assigned HWQ factor value for the surface water migration pathway is 100 (Ref. 1, p. 51591, Table 2-6).

4.1.4.2.3 Waste Characteristics Factor Category Value

The waste characteristics factor category value is obtained by multiplying the highest toxicity, persistence, and bioaccumulation factor value by the HWQ factor value (Ref. 1, p. 51620). The product is assigned a waste characteristics factor category value from HRS Table 2-7 (Ref. 1, p. 51592). The highest toxicity, persistence, and bioaccumulation factor values assigned to the surface water migration pathway were for benzo(a)anthracene, benzo(a)pyrene, Aroclor-1248, Aroclor-1254, Aroclor-1260, and dioxin, which have a toxicity factor value of 10,000, a persistence factor value of 1, and a bioaccumulation factor value of 50,000 (Ref. 2).

Toxicity/Persistence/Bioaccumulation factor value (5×10^8) × HWQ factor value (100) = 5×10^{10}

A waste characteristics factor category value of 320 was assigned from HRS Table 2-7 (Ref. 1, p. 51592).

Hazardous Waste Quantity Assigned Value: 5×10^{10}
Waste Characteristics Category Value: 320

4.1.4.3 ENVIRONMENTAL THREAT - TARGETS

The surface water migration pathways for the Lower Darby Creek Area encompass the John Heniz National Wildlife Refuge, wetlands, and other sensitive environments.

The following aqueous samples demonstrate observed releases to surface water at or downstream of the site. These samples include concentrations above risk-based benchmarks; therefore, these samples are evaluated as Level I concentrations.

Level I Concentrations:

Sample ID: DAR/SW35
Sample Medium: surface water
Location: Hermesprota Creek
Reference: see Section 4.1.2.1.1, Table SW-15

Hazardous Substance	Hazardous Substance Concentration	Benchmark Concentration	Benchmark
Iron	17,500 ug/L	1,000 ug/L	AWQC
Lead	385 ug/L	3.2 ug/L	AWQC
Zinc	792 ug/L	110 ug/L	AWQC

Sample ID: DAR/SW38
Sample Medium: surface water
Location: Darby Creek
Reference: see Section 4.1.2.1.1, Table SW-12

Hazardous Substance	Hazardous Substance Concentration	Benchmark Concentration	Benchmark
Cadmium	88.9 ug/L	1.1 ug/L	AWQC

Sample ID: DAR/SW39
Sample Medium: surface water
Location: Hermesprota Creek
Reference: see Section 4.1.2.1.1, Table SW-15

Hazardous Substance	Hazardous Substance Concentration	Benchmark Concentration	Benchmark
Cadmium	55 ug/L	1.1 ug/L	AWQC
Chromium	1,520 ug/L	11 ug/L	AWQC
Copper	2,070 ug/L	12 ug/L	AWQC
Iron	987,000 ug/L	1,000 ug/L	AWQC
Lead	3,890 ug/L	3.2 ug/L	AWQC
Nickel	784 ug/L	160 ug/L	AWQC
Zinc	9,200 ug/L	110 ug/L	AWQC

Sample ID: DAR/SW50
Sample Medium: surface water
Location: Darby Creek
Reference: see Section 4.1.2.1.1, Table SW-12

Hazardous Substance	Hazardous Substance Concentration	Benchmark Concentration	Benchmark
Iron	14,800 ug/L	1,000 ug/L	AWQC
Mercury	0.21 ug/L	0.012 ug/L	AWQC
Zinc	203 ug/L [a]	110 ug/L	AWQC

Sample ID: DAR/SW52
Sample Medium: surface water
Location: Darby Creek
Reference: see Section 4.1.2.1.1, Table SW-12

Hazardous Substance	Hazardous Substance Concentration	Benchmark Concentration	Benchmark
Iron	7,000 ug/L	1,000 ug/L	AWQC

Sample ID: DAR/SW54
Sample Medium: surface water
Location: Darby Creek
Reference: see Section 4.1.2.1.1, Table SW-12

Hazardous Substance	Hazardous Substance Concentration	Benchmark Concentration	Benchmark
Cadmium	12.2 ug/L [a]	1.1 ug/L	AWQC

Reference for Benchmarks: 2
[a] concentration has been adjusted according to Reference 33

Most Distant Level I Sample

Sample ID: DAR/SW54
Distance from the PPE: 3.25 miles
Reference: 31, Figure 7

Most Distant Level II Sample

All Level II samples are located within the zone of Level I contamination. Therefore Level II concentrations are not listed.

Sample ID: NA
Distance from the PPE: NA
Reference: NA

4.1.4.3.1 Sensitive Environments

The Lower Darby Creek area includes the 1,200 acre John Heinz NWR at Tinicum (formerly the Tinicum National Environmental Center) which is the largest freshwater tidal marsh in Pennsylvania. The refuge includes 350 acres of tidal marsh. The refuge is located near the confluence of Darby Creek and the Delaware River. It was established by Congress in 1972 to preserve diverse fish and wildlife habitat for natural and educational purposes. In 1998, over 100,000 people visited John Heinz NWR to engage in hiking, bicycling, canoeing, fishing, bird watching, nature photography, environmental education, and other outdoor related activities (Ref. 89; Ref. 24, p. II-1).

The diversity of habitat at the refuge provides the food, cover, and nesting requirements for a variety of wildlife. The tidal marsh is characterized by zones of wetland plants such as wild rice, spatter-dock, cattail, and countless combinations of associated plant species (Ref. 24, p. II-6). The values of this wetland type to birds are magnified in the case of the refuge marshes because of their strategic location on the Atlantic Flyway. Delaware Bay represents a major interchange on the Atlantic Flyway. The refuge is used intensely by migrating birds for food and protection. Over 280 species of birds have been observed in the refuge (Ref. 36, p. III-14). The 145-acre impoundment east of the Folcroft Landfill attracts wintering waterfowl and is home to numerous other bird, reptile, amphibian, and fish species. A heron rookery is on a brushy island habitat within the 145-acre impoundment. In addition, three plant species listed as "proposed rare" by the Commonwealth of Pennsylvania occur in the refuge (Ref. 24, p. II-6). They include: rive bulrush (Scirpus fluviatilis), Indian wild rice (Zizania aqauatica), and waterhemp ragweed (Amaranthus cannabinus). Wright's spike-rush (Elecharis obtusa), a Pennsylvania "tentatively undermined" species, has also been observed at the refuge (Ref. 36, p. III-10).

Over 40 species of fish have been documented at the refuge, including anadromous and catadromous species such as the American shad, white perch, blueback herring, alewife, gizzard shad, and American eel. Almost 30 species of amphibians and reptiles have been reported at the refuge, including several listed rare or threatened by the Commonwealth of Pennsylvania. The large snapping turtles that inhabit the refuge have been harvested commercially in the past. Over 280 species of birds have been reported to use the varied habitats present at the refuge. Nine species of waterfowl nest in the refuge. In addition, six bird species nesting at the refuge that have been identified as "Species of Special Emphasis" by the FWS are the wood duck, black duck, American woodcock, snowy egret, black-crowned night heron, and great egret (Reg. 24, p. II-6; Ref. 36, pp. III-18 to III-20). Darby Creek and the surrounding John Heinz NWR provide habitat for migrating birds and waterfowl (Ref. 36, p. III-14; Ref. 24, p. II-6).

Darby Creek, Cobbs Creek, Muckinipattis Creek, Thoroughfare Creek, and Hermesprota Creek are the major streams which form the refuge watershed (Ref. 24, p. II-5). The PADER designated protected water use for these five streams. These uses are Warm Water Fishery, industrial water supply, live-stock water supply, wildlife water supply, irrigation, boating, fishing, water contact sports, and aesthetics (Ref. 36, p. III-1).

4.1.4.3.1.1 Level I Concentrations

An observed release to surface water has been documented for Darby Creek and Hermesprota Creek based on surface water sampling results; Level I concentrations are present for surface water targets within the TDL for the Lower Darby Creek Area as described below. Figure 20 shows the extent of Level I contamination in Darby Creek and Hermesprota Creek.

Sensitive Environments

TABLE SW-33
LEVEL I SENSITIVE ENVIRONMENTS

Sensitive Environment	Distance from PPE from Folcroft Landfill and Annex to Nearest Sensitive Environment	Reference	Value(s)
John Heinz NWR at Tinicum	0	49	75
Red-bellied turtle	0	49	75
Southern leopard frog	0	79	75
American bittern	0	81	50
Least bittern	0	81	50
Great egret	0	81	50
Walter's barnyard grass	0	79	50
Wright's spike rush	0	79	50
Little-spike spike rush	0	79	50
Multiflowered mud-plantain	0	79	50
Long-lobed arrow-head	0	79	50
Smith's bullrush	0	79	50
Spring ladies' tresses	0	79	50

Sum of Sensitive Environments Value: 725

Wetlands

The wetland frontage located on Darby Creek was measured on Reference 84. A map wheel, which measures distances on maps, was used to measure the length of each wetland within the area of Level I contamination. The measurement was taken from the most upstream point of the wetland to the most downstream point of the wetland between the locations of the most upstream Level I sample, DAR/SW38 and the most downstream level I sample, DAR/SW54.

Wetland	**Wetlands Frontage**	**Reference**
Darby Creek wetlands	36,000 feet/6.8 miles	84

Total Wetlands Frontage: 6.8 miles
Wetlands Value: 150

Sum of Sensitive Environments Value + Wetlands Value × 10: 8,750
==========

Level I Concentrations Factor Value: 8,750

A copy of Figure 20 is available at the EPA Headquarters Superfund Docket:

U.S. CERCLA Docket Office
Crystal Gateway #1, 1st Floor
1235 Jefferson Davis Highway
Arlington, VA 22202

Telephone: (703) 603-8917
E-Mail: superfund.docket@epa.gov

4.1.4.3.1.2 Level II Concentrations

Sensitive Environments

An observed release to surface water has been established for Darby Creek based on surface water and sediment sampling results; however, Level I concentrations have already been identified and the Level II concentrations outside of this zone are found in only one sample, SD-36, no calculations are made for areas of Level II contamination.

Sum of Sensitive Environments Value: 0

Wetlands

Wetland	Wetlands Frontage (miles)	References

Total Wetlands Frontage: 0
Wetlands Value: 0

Sum of Sensitive Environments Value + Wetlands Value: 0

==========

Level II Concentrations Factor Value: 0

4.1.4.3.1.3 Potential Contamination

Potential contamination to sensitive environments is not evaluated because of the large value assigned to Level I sensitive environments. Evaluation of potential contamination of sensitive environments is not expected to significantly affect the site score.

Sensitive Environments

NA

Type of Surface Water Body	Sensitive Environment	Reference(s)	Sensitive Environment Value(s)

NA

Wetlands

NA

Type of Surface Water Body	Wetlands Frontage (miles)	Reference(s)	Wetlands Value for Type of Surface Water Body

NA

Type of Surface Water Body	Sum of Sensitive Environment Values (S_j) $D_j(W_j + S_j)$	Wetlands Frontage Value (W_j)	Dilution Weight (D_j) (HRS Table 4-13)

NA

Sum of $D_j(W_j + S_j)$: 0
(Sum of $D_j(W_j + S_j)$)/10: 0

==========

Potential Contamination Factor Value: 0